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Bulletin 111

A MONOGRAPH OF THE EAST AMERICAN SCAPHOPOD MOLLUSKS

BY

JOHN B. HENDERSON
Of Washington, District of Columbia

WASHINGTON
GOVERNMENT PRINTING OFFICE
1920

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
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The scientific publications of the United States National Museum consist of two series, the *Proceedings* and the *Bulletins.*

The *Proceedings*, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original, and usually brief, papers based on the collections of the National Museum, presenting newly acquired facts in zoology, geology, and anthropology, including descriptions of new forms of animals, and revisions of limited groups. One or two volumes are issued annually and distributed to libraries and scientific organizations. A limited number of copies of each paper, in pamphlet form, is distributed to specialists and others interested in the different subjects, as soon as printed. The dates of publication are recorded in the tables of contents of the volumes.

The *Bulletins*, the first of which was issued in 1875, consist of a series of separate publications comprising chiefly monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, and catalogues of type-specimens, special collections, etc. The majority of the volumes are octavos, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable.

Since 1902 a series of octavo volumes containing papers relating to the botanical collections of the Museum, and known as the *Contributions from the National Herbarium*, has been published as bulletins.

The present work forms No. 111, of the *Bulletin* series.

William deC. Ravenel,
Administrative Assistant to the Secretary,
in charge of the United States National Museum.

Washington. D. C., June 20, 1920.

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A MONOGRAPH OF THE EAST AMERICAN SCAPHOPOD MOLLUSKS.

BY JOHN B. HENDERSON,
Of Washington, District of Columbia.

INTRODUCTION.

During the latter part of the eighteenth and the first quarter of the nineteenth century many species of the abundant shallow water mollusks of the western Atlantic, especially of the larger and more conspicuous Antillean forms, were described by European naturalists. Between 1820 and 1840 several American naturalists, notably Conrad and Say, added a number of species to the American list, their material coming mostly from the Atlantic and Gulf coasts of the United States. At that time there had been little or no dredging done, nor, indeed, had any attempt been made at systematic, much less intensive, collecting. Only those easily acquired mollusks were known that lived either in the shallow water of bays or that had been cast upon exposed beaches. As the American Scaphopods live below tidal range and are rarely found upon beaches they almost wholly escaped the notice of the earlier collectors. A few Dentalia, probably from Antillean beaches, had, however, found place in foreign collections and were described in the careless manner of the time, usually with doubtful or no locality records attached. Such species were *Dentalium semistriatum* of Turton, published in 1819 as coming from Dublin Bay, and also *D. nebulosum* of Deshayes in 1825. In 1834 Guilding described *D. semistriolatum* and *D. sowerbyi* as positively Antillean species, and these stand as the first recorded of our Dentalia that may be accepted with reasonable assurance. Chenu, in the first volume of his imposing series of Illustrations Conchyliologiques, appearing about 1843, gives excellent figures of his own and of Deshayes's species of Dentalium, some of which may belong to the western Atlantic. These are *Dentalium nebulosum* Deshayes (already referred to), *D. translucidum* Chenu, *D. americanum* Chenu, *D. pictei* (Deshayes) Chenu, *D. ensiforme* Chenu, and a few others that are suspiciously like some well-known West Indian forms. There are good reasons, to be later discussed, for rejecting them all for our present list.

During the decade from 1840 to 1850 five undoubtedly valid American species were added to Guilding's accepted two. These were Orbigny's *D. antillarum*, *D. disparile*, and *D. dominguensis* (Cadulus) 1846, from Antillean shores, excellently figured in his report upon the mollusks in Sagra's Natural History of Cuba; Philippi's *D. texasianum* from Galveston, 1848, and Conrad's *D. eboreum*, 1846, from Tampa. These are all from definite localities, Philippi's specimens having been sent him by Roemer.

About this time (1840–1850) there was considerable activity among students of the molluscan fauna of New England. Gould published his Invertebrates of Massachusetts in 1841, in which he referred a New England *Dentalium* to the *Dentalium dentale* of Linnaeus, and two years later Mighels, in another list of New England shells, added *D. entale* of Linnaeus. Both these names were destined to be cast aside and restored many times by subsequent writers, who believed or not that these American shells were merely western examples of the European species of Linnaeus.

In 1850, then, there were eight positively known species of Scaphopods from the western Atlantic, two of which were regarded as identical with European forms. The following year, William Stimpson published his Shells of New England, in which he disposed of *D. dentale* Linnaeus as an American species, in favor of his own *D. occidentale*. The species already referred to by Mighels as *entale* Linnaeus he redescribed the same year as *D. striolatum*, as he doubted the identity of the American and the European shells.

From 1851 to 1879 there were no direct additions to the short American Scaphopod list. In 1860 Sowerby published a monograph of the Dentalia in his Thesaurus Conchyliorum. Among the new species therein described three are of interest to us, as having been accepted later on as identical with American forms. These are *D. filum*, *D. fistula*, and *Siphonodentalium lobatum*. In 1870 Jeffreys published *D. gracile* and in 1877, *Cadulus cylindratus*, and *D. ensiculus* (from European waters), species later considered as also American mollusks. All these six species are northeastern Atlantic.

The first large and important addition to our Scaphopod list came in 1879 as a result of the work of the *Challenger*. Doctor Boog Watson published in that year in the Journal of the Linnean Society a preliminary descriptive list of Scaphopoda (among others) obtained by that famous expedition (1872–1876). All the new American species described therein were obtained from four *Challenger* stations only, located between Prince Edward Islands on the north and Fernando Noronha on the south, and in depth from 25 to 450 fathoms. In 1885 these various species were republished and figured in Watson's massive report upon the *Challenger* Scaphopods and Gasteropods. For care and fidelity in description and in the thoroughness of his methods Doctor Watson set an entirely new pace in systematic work. The additions to the western Atlantic Scaphopods therein made, including his own new species and those of others regarded by him as American as well as European, are as follows:

Dentalium capillosum Jeffreys (1876).
Dentalium entalis orthrum Watson.
Dentalium circumcinctum Watson.
Dentalium compressum Watson.
Dentalium subterfissum Jeffreys (1877).
Dentalium didymum Watson.
Dentalium ensiculus Jeffreys (1877).
Siphonodentalium platamodes Watson.
Siphonodentalium tytthum Watson.
Siphonodentalium tetraschistum Watson.
Cadulus vulpidens Watson.
Cadulus rastridens Watson.
Cadulus sauridens Watson.
Cadulus curtus Watson.
Cadulus curtus congruens Watson.
Cadulus curtus obesus Watson.
Cadulus exiguus Watson.
Cadulus ampullaceus Watson.

The *Challenger* was by no means the first to use the dredge in American waters. The United States Coast Survey steamers *Corwin* in 1867, the *Bibb* in 1868–9, the *Hassler* in 1871–2, the *Bache* in 1872, all made marine explorations with the dredge in connection with other oceanographic work in the Gulf of Mexico, the Straits of Florida, off Yucatan, in the Caribbean, and in the Atlantic off Brazil. The names of Count Pourtales, Louis Agassiz, and William Stimpson are connected with these vessels but the amount of Scaphopod material derived from their dredgings appears not to have been great. In the case of the *Bibb*, which, under the direction of Pourtales, worked in the exceedingly rich region off the Florida Keys, it is likely that a fine lot of mollusks would have been added to the Government collections had it not been for their destruction in the great Chicago fire while in the possession of William Stimpson, to whom they had been given for report.

It is to the Coast Survey steamer *Blake*, during her three cruises (1877–1880) in the Gulf of Mexico and Antillean waters, that are due the largest and most important additions to our knowledge of the American Scaphopoda. Under the able direction of Alexander Agassiz and the command of officers, who fortunately took a keen interest in the work, an exceptionally large amount of material was obtained from many stations and from depths ranging from a few fathoms to the ocean floor. Dr. William H. Dall, with his usual thoroughness, reported upon this great collection of mollusks in two Bulletins of the Museum of Comparative Zoology of the years 1881 and 1889. There appeared by far the most important as well as the most extensive addition to our Scaphopod list. Over 20 new species were described and figured. They are as follows:

Cadulus aequalis Dall, 1881.
Cadulus watsoni Dall, 1881.
Cadulus agassizii Dall, 1881.
Cadulus lunula Dall, 1881.
Cadulus cucurbitus Dall, 1881.
Cadulus quadridentatus Dall, 1881.
Cadulus poculum, 1889.
Cadulus carolinensis bushii Dall, 1889.
Cadulus amiantus Dall, 1889.
Cadulus acus Dall, 1889.
Cadulus minusculus Dall, 1889.
Dentalium perlongum Dall, 1881.
Dentalium sericatum Dall, 1881.
Dentalium ceratum Dall, 1881.
Dentalium sigsbeanum Dall, 1881.
Dentalium ophiodon Dall, 1881.
Dentalium callipeplum Dall, 1889.
Dentalium matara Dall, 1889.
Dentalium calamus Dall, 1889.
Dentalium taphrium Dall, 1889.
Dentalium carduus Dall, 1889.
Dentalium gouldii Dall, 1889.
Dentalium callithrix Dall, 1889.

Besides the above new forms almost all the American species thereto described were included in the reports for comment or discussion, and some foreign names were adopted for otherwise new American species.

Following the activities of the *Blake*, explorations were made by steamers of the United States Fish Commission in the deeper waters off the New England coast and off the Delaware Capes, extending their field of operations to the Hatteras region, from inshore stations to the abyssal depths beyond the continental slope. These were the *Fish Hawk* in 1880–1882, and the *Albatross* in 1883–4. The mollusks so obtained were made subjects of a series of papers by A. E. Verrill, published in the Transactions of the Connecticut Academy of Arts and Sciences in 1882, 1883, and 1885, and also by Katherine Bush in the same publication in 1885. The Verrill and Bush Scaphopods so added to our list are as follows:

1882.

Cadulus pandionis Verrill.

1884.

Dentalium solidum Verrill.
Dentalium occidentale sulcatum Verrill.
Cadulus grandis Verrill.

1885.

Dentalium laqueatum Verrill.
Dentalium leptum Bush.
Cadulus spectabilis Verrill.
Cadulus carolinensis Bush.
Cadulus incisus Bush.

To the above new species Verrill and Bush referred other American Scaphopoda to English and Norwegian species as follows:

Cadulus propinquus Sars.
Cadulus jeffreysii Monterosato.
Cadulus cylindratus Jeffreys.
Siphonodentalium lofotensis Sars.
Siphonodentalium affinis Sars.
Siphonodentalium vitrium Sars.
Siphonodentalium teres Jeffreys.
Dentalium ensiculus Jeffreys.

The *Albatross* also made some further explorations in the Gulf of Mexico and the Caribbean, and, finally, while leaving the Atlantic in 1887, established a series of stations along the South American coast. Doctor Dall published the results in 1892 in the Proceedings of the United States National Museum. This added to our already expanded list *Dentalium ceras* Watson, *D. candidum* Jeffreys, and *Cadulus tumidosus* Jeffreys.

No further additions were made until the appearance of Pilsbry and Sharp's monograph of the Scaphopoda in 1897-8, this being volume 17 of Tryon's Manual of Conchology. In this comprehensive work the authors carefully redefined all subgenera, grouped the species according to their affinities, made many useful keys, amplified many old descriptions, and illustrated anew many types in scales of large magnification. Although a monographic work upon the Scaphopoda of the world in general, it remains to-day, for our western Atlantic forms, the last and best word upon the subject. The following new species and subspecies to be included in our list where therein created:

Dentalium meridionale Pilsbry and Sharp.
Dentalium liodon Pilsbry and Sharp.
Dentalium liodon alloschismum Pilsbry and Sharp.
Dentalium pressum Pilsbry and Sharp (new name for *compressum* Watson).
Dentalium stenoschizum Pilsbry and Sharp.
Cadulus tetrodon Pilsbry and Sharp.
Cadulus hatterasensis Pilsbry and Sharp.
Cadulus rushii Pilsbry and Sharp.

The collection in the United States National Museum of the Scaphopods of the Western Atlantic is made up of the type lot material from the various United States governmental collecting sources heretofore mentioned, together with some material obtained by exchange or gift. Such was the collection in 1898 when consulted by Doctor Pilsbry in the preparation of his monographic work. During the past 20 years the museum collection has been greatly augmented. Many specimens have been culled from hitherto unsifted lots of *Albatross* material dredged in the Gulf and Caribbean in 1885 and 1886. Other lots have been received from shallow-water Antillean stations obtained by numerous collectors. Much material has also been received from the Bureau of Fisheries Station at Beaufort, North Carolina, collected by the *Fish Hawk* during the last few years in the region about Cape Lookout. Several hundred lots of Scaphopods have been added to the collection during the last five years from my own dredgings in the yacht *Eolis*, operating in the Florida Keys region from Tortugas to Miami and in the Bahamas in depths from the shore to about 200 fathoms. Much interesting material has also been received from the *Tomas Barrera* expedition to western Cuba, furnishing probably a very complete series of the shallow-water forms of Cuba. Finally, a share of the material taken by the State University of Iowa Expedition to the Barbados in 1918 has been added to the national collection.

It was the attempt to identify and classify this 20 years' accumulation of new material that led to a review of the whole collection, which, in turn, furnishes the subject matter of this paper. The following new species and subspecies are herein described:

Dentalium laqueatum regulare.
Dentalium texasianum cestum.
Dentalium texasianum rioense.
Dentalium gouldii portoricense.
Dentalium gouldii colonense.
Dentalium rebeccaense.
Dentalium entale stimpsoni.
Dentalium agile subagile.
Dentalium occidentale georgiense.
Dentalium ceratum flavum.
Dentalium ceratum tenax.
Dentalium bartletti.
Dentalium tubulatum.
Dentalium meridionale jamaicense
Dentalium meridionale verrilli.
Dentalium floridense.
Dentalium amaliense.
Dentalium sowerbyi pelliceri.
Entalina quadrata.
Siphonodentalium striatinum.
Siphonodentalium verrilli.
Siphonodentalium occidentale.
Siphonodentalium bushi.
Cadulus quadridentatus acompsus.
Cadulus elephas.
Cadulus catharus.
Cadulus parvus.
Cadulus foweyensis.
Cadulus portoricensis.
Cadulus rushi arne.
Cadulus providensis.
Cadulus elongatus.
Cadulus greenlawi.
Cadulus arctus.
Cadulus braziliensis.
Cadulus simpsoni.
Cadulus nitidus.
Cadulus miamiensis.
Cadulus mayori.
Cadulus iota.
Cadulus subula.
Cadulus verrilli.
Cadulus regularis.
Cadulus atlanticus.
Cadulus transitorius.
Cadulus transitorius barbadensis.
Cadulus platensis.
Cadulus podagrinus.
Cadulus halius.
Cadulus tersus.

Before proceeding to the consideration of the genera and species I wish to make grateful acknowledgment to the officials of the United States National Museum for the privilege accorded me to consult and freely to use the great collection of *Scaphopods* in their care, and for their courtesy and invaluable aid rendered me in the preparation of this paper.

I am also greatly indebted to Dr. Henry A. Pilsbry, curator of the conchological section of the Philadelphia Academy of Sciences, for the generous loan of the Academy collection of *Dentalia* and *Caduli*, and I am equally indebted to Mr. William F. Clapp, in charge of the collection of mollusks in the Museum of Comparative Zoology in Cambridge, Massachusetts, for his courtesy in sending me all the American Scaphopods of that collection.

CLASSIFICATION OF THE SCAPHOPODA.

The class Scaphopoda includes but two families—the Dentaliidae and the Siphonodentaliidae. The distinctions between them are based upon (*a*) differences in the median tooth of the radula, (*b*) the form of the foot, (*c*) certain quite definite shell characters.[1]

The Dentaliidae has the median tooth of the radula twice as wide as long; a pointed conical foot surrounded by an epipodial process resembling a wingshaped sheath, which is interrupted or slit, like the break in a fold, on one side; a shell with greatest diameter at aperture. The shell is almost always, to some extent at least, sculptured.

The Siphonodentaliidae has the median tooth of the radula less than double its length. The foot lacks any epipodial processes, and is either a slender vermiform organ or is expanded on the end into a symmetrical disk with fluted or indented border. The shell, except in one restricted group, wholly lacks sculptural features, being smooth and glassy in texture, and it is generally contracted at the aperture.

Family DENTALIIDAE.

The family Dentaliidae possesses but one genus—*Dentalium*. This has been subdivided into a number of subgenera based chiefly upon apical characters of the shell. The actual value of these apical characters for the purpose of classification, and therefore the value of subgenera chiefly based upon them, is not altogether assured, but in a genus embracing so many species some form of division is useful, even though it be somewhat artificial. Any one character, if relied upon to distinguish the larger groups, answers well enough for a time, but it always seems eventually to invite trouble. The shell characters that may be used better in combination for the larger or the smaller groups are: Type of sculpture, the form of the tip, the degree of curvature, the size and thickness of the shell, the position and form of the apical slit.[2]

---

[1] For detailed study of the anatomy of the Scaphopoda see Lacaze-Duthiers, Historie de l'orginisation et du developpement du Dentale. Ann. des Sci. Nat. (Zool.), vol. 4, pp. vi, vii, (1856–7); Simroth, Bronn's Klassen und Ordnungen des Thier-Reichs (new ed.), vol. 3, pp. 356–467, (1895); Lang, Text Book of Comp. Anatomy (English translation by Bernard), Part 2 (1896) (see index for many references); Pilsbry and Sharp, Tryon's Manual of Conchology, vol. 17 (1897–8) (see pp. xi–xiv for references to literature); Pelseneer, Mollusca, vol. 5 of Treaties on Zoology (Lankester), pp. 197–204 (1906) (see bibliography on page 204). The earlier researches of Deshayes, Sars, and others are fully reviewed in the works mentioned.

[2] For discussion of the relative values of subgeneric characters in the Scaphopoda see Pilsbry and Sharp in Tryon's Manual of Conchology, vol. 17, p. ix of the introduction, also p. xxix. See also Dall in Transactions of the Wagner Institute, vol. 3, part 2, p. 435.

Genus DENTALIUM Linnaeus, 1758.

1758. *Dentalium* Linnaeus, Syst. Nat., ed. 10, p. 785.

Type.—D. elephantinum Linnaeus (Amboyna).

Shell an elongate tube open at both ends, increasing in diameter from the apex to the aperture, the section of maximum diameter being coincident with the peristome; almost straight to strongly curved; usually sculptured with longitudinal (lengthwise as from tip to aperture) riblets or engraved lines, especially near the tip or on the posterior portion. The sculptural features may vary in degree from faint indications to strong heavy ribs, and these may vary in number from 6 to 60 or more. The original number of ribs or riblets in the apical portion are often increased later by the addition of others intercalated between them, so that as the animal grows its shell increases in the number of its ribs. Frequently all sculptural features present in the posterior or middle portion of the shell disappear in the anterior portion, the senile stage showing a smooth surface. The sculpture is sometimes further modified by fine transverse lirae occupying the spaces between the longitudinal ribs or even crossing them. Again, the intercostal surface may present a fine reticulated plan of excessively minute sculptural elements. In some groups there are no sculptural features whatever. The embryonic portion of the apex is very minute and fragile, and is always lost, save rarely, in very young specimens. The apical section remaining may be round or angular in section, in which latter case the angles become the beginnings of the primary ribs or riblets. The apical opening is usually modified by a slit or notch of varying width or depth and variously placed in different groups; or the opening may be simple without either notch or slit. The shell varies in size from minute needle-like forms to those of 4 or 5 inches in length, in thickness from fragile to heavy and solid; in texture from soft and chalky to hard porcellanous or glassy; in color from occasional greenish, reddish, or yellowish species to pure white, the latter greatly predominating. The shells may be transparent, translucent to opaque, dull lusterless to the most highly polished and glistening surface.

The animal is shaped like the shell it occupies—elongate, wrapped in a mantle open at both ends. From the larger end a pointed cylindrical foot may be protruded or almost wholly withdrawn. It is capable of more or less expansion at the end. There are no tentacles or eyes. Just back of the mouth is a cluster of thread-like appendages enlarged into spoon-shaped terminals (captaculae). The exact function of these seems not to be definitely understood, but they are supposed to catch and hold the food, consisting largely of foraminifera and other minute organisms. The liver is two-lobed, the gonad simple; the heart consists of one ventricle, and there are no gills. The excretory openings are in the forward part of the mantle cavity, but the escape of fecal and of sexual products is through the smaller end of the shell. The sexes are distinct. The nervous system consists of symmetrically placed central, pleural, pedal, visceral, and buccal ganglia.

The subgenera of *Dentalium* under which the species of the western Atlantic fall are: *Dentalium* (s. s.), *Antalis*, *Heteroschisma*, *Fissidentalium*, *Graptacme*, *Laevidentalium*, *Episiphon*, *Bathoxiphus*, *Compressidens*, and *Fustiaria*. These will be more particularly discussed under the separate headings for each group, but for a more immediate and general acquaintance the following synopsis of characters is presented. The distinctions can not be sharply drawn, and some species listed under one heading may partake more or less of the characters of some other group.

SYNOPSIS OF THE SUBGENERA OF DENTALIUM.

Tip: Angled, polygonal in section.
  Sculpture: Primary ribs prominent; 6, 9, 10, or 12 primary ribs in American forms.
    Apical features: A notch or shallow slit on the convex side, or apparently wanting
      Size: Medium to large.......................... *Dentalium*, page 22.
Tip: Less distinctly polygonal, "sometimes round."
  Sculpture: Riblets 6 to 18, sometimes almost obsolete.
    Apical features: Notch (not slit) on convex side or absent.
      Size: Medium or very long and slender............... *Antalis*, page 34.
Tip: Polygonal, American forms, with 9-angled section.
  Sculpture: Coarse riblets, but not strongly ribbed.
    Apical features: Slit on concave side.
      Size: Medium to large......................... *Heteroschisma*, page 56.
Tip: Indistinctly polygonal, hexagonal.
  Sculpture: Very many riblets.
    Apical features: Long, narrow slit on convex side.
      Size: Very large.......................... *Fissidentalium*, page 58.
Tip: Round.
  Sculpture: None.
    Apical features: Apical slit generally on convex side or sometimes laterally placed.
      Size: Small...................................... *Graptacme*, page 65.
Tip: Round.
  Sculpture: None.
    Apical features: Apical slit generally on convex side.
      Size: Small or long and slender............. *Laevidentalium*, page 73.
Tip: Round.
  Sculpture: None.
    Apical features: No slit, usually a projecting "pipe."
      Size: Very small, needle-like...................... *Episiphon*, page 77.
Tip: Unknown.
  Sculpture: None.
    Apical features: Broad slit on convex side.
        Special features: Strongly compressed laterally.
          Bathoxiphus, page 81.

Tip: Unknown.
  Sculpture: None.
    Apical features: None.
      Size: Small.
        Special features: Strongly compressed between convex and concave sides.............................*Compressidens*, page 83.

Tip: Unknown.
  Sculpture: None.
    Apical features: Very long, straight, linear slit on or near the convex side.
      Size: Medium..................................*Fustiaria*, page 86.

Family SIPHONODENTALIIDAE.

This, the second family of the Scaphopoda (see p. 87 for the essential features), contains the three genera, *Entalina*, *Siphonodentalium*, and *Cadulus*. These may be roughly diagnosed as to shell characters in synoptical form, as follows:

Form: Greatest diameter at aperture, strongly curved.
  Apical features: Nuclear apex round in section, becoming hexagonal.
    Sculpture: Very fine longitudinal riblets.
      Size: Small..*Entalina*, page 87.

Form: Greatest diameter at aperture, strongly curved.
  Apical features: Apex round in section.
    Sculpture: None; highly polished surface.
      Size: Small.............................*Siphonodentalium*, page 88.

Form: Greatest diameter not at the aperture.
  Apical features: None.
    Sculpture: None.
      Size: Small.......................................*Cadulus*, page 95.

Genus ENTALINA Monterosato, 1872.

1872. *Entalina* MONTEROSATO, Notizia intorno alle Conch. Foss. di Monte Pellegrino e Ficarazzi, p. 27.

Type.—*E. tetragona* Brocchi (Italian fossil).

Shell *Dentalium*-like in having the greatest diameter at the aperture. Very strongly curved, small, and sculptured with longitudinal fine riblets. The apex (except in the nuclear portion) is angular; in the two American species quadrate. The angled apex and sculptural features suggest a true *Dentalium*, but the form of the foot and other anatomical features indicate a position under the Siphonodentaliidae.

This genus needs no further subdivision.

Genus SIPHONODENTALIUM Sars, 1859.

1859. *Siphonodentalium* SARS, Forh. Videnskabs-Selskabet, Christiania, p. 52.

Type.—*S. vitreum* Sars (north Europe).

Shell strongly arcuate, slightly tapering with maximum diameter at aperture. Circular in section and without sculpture. Apex large and either simple or cut into lobes.

The genus has been divided into two "sections," according to the presence or absence of apical lobes, but the value of the subdivisions may be questioned. They are:

Apex with slits or lobes............................*Siphonodentalium* s. s., page 88.
Apex simple..*Pulsellum*, page 92.

Genus CADULUS Philippi, 1844.

1844. *Cadulus* PHILIPPI, Enum. Moll. Sicil., vol. 2, p. 209.

Type.—*C. ovulum* Philippi. (Mediterranean.)

Shell scupltureless, smooth, polished, of circular or oval section. More or less arcuate, with a greater or lesser swelling or bulge near the middle or between the median portion and the aperture. Aperture usually somewhat contracted and never the section of greatest diameter of the shell. Apical characters vary from simple to two or four deeply or slightly cut notches.

The division of *Cadulus* into subgenera of doubtful value finds an excuse only in the aid it offers in grouping conveniently a large number of species of slight diagnostic features. Possibly the value of *Polyschides* from a biologic point of view may be less questioned as a subgenus distinct from what is accepted as typical *Cadulus*, but the others are rather artificial. The following is the order of subdivision offered by Pilsbry and Sharp with the addition of *Platyschides:*

Apex with two prominent slits..*Dischides*.
Apex with four prominent slits leaving four prominent triangular lobes, *Polyschides*, page 96.
Apex with four very shallow notches leaving four wide lobes.....*Platyschides*, page 104.
Apex not slit or notched.
    Small obese forms....................................*Cadulus* s. s., page 141.
    Slender forms..*Gadila*, page 130.

The subgenus *Dischides* characterized by two slits in the apex is as yet unknown from the faunal areas under consideration.

LIST OF THE EAST AMERICAN SCAPHOPODS.

Dentalium (*Dentalium*) *laqueatum* Verrill 1885, page 23.
Dentalium (*Dentalium*) *laqueatum laqueatum* Verrill 1885, page 24.
Dentalium (*Dentalium*) *regulare*, new subspecies, page 26.
Group of *D. texasianum:*
    Dentalium (*Dentalium*) *texasianum* Philippi 1848, page 27.
    Dentalium (*Dentalium*) *texasianum texasianum* Philippi 1848, page 28.
    Dentalium (*Dentalium*) *texasianum cestum*, new subspecies, page 29.
    Dentalium (*Dentalium*) *texasianum rioense*, new subspecies, page 29.
    Dentalium (*Dentalium*) *gouldii* Dall, 1889, page 29.
    Dentalium (*Dentalium*) *gouldii gouldii* Dall, 1889, page 30.
    Dentalium (*Dentalium*) *gouldii portoricense*, new subspecies, page 30.
    Dentalium (*Dentalium*) *gouldii colonense*, new subspecies, page 31.
    Dentalium (*Dentalium*) *rebeccaense*, new species, page 31.
    Dentalium (*Dentalium*) *obscurum* Dall, 1890, page 32.
    Dentalium (*Dentalium*) *carduus* Dall 1889, page 33

- Group of *D. occidentale:*
  - *Dentalium* (*Antalis*) *entale stimpsoni*, new name, page 35.
  - *Dentalium* (*Antalis*) *agile subagile*, new subspecies, page 38.
  - *Dentalium* (*Antalis*) *occidentale* Stimpson, 1851, page 40.
  - *Dentalium* (*Antalis*) *occidentale occidentale* Stimpson, 1851, page 41.
  - *Dentalium* (*Antalis*) *occidentale georgiense*, new name, page 43.
- Group of *D. antillarum:*
  - *Dentalium* (*Antalis*) *antillarum* Orbigny 1846, page 44.
  - *Dentalium* (*Antalis*) *pseudohexagonum* Ihering, page 46.
  - *Dentalium* (*Antalis*) *disparile* Orbigny, 1846, page 47.
- Group of *D. ceratum:*
  - *Dentalium* (*Antalis*) *ceratum* Dall, 1881, page 49.
  - *Dentalium* (*Antalis*) *ceratum ceratum* Dall, 1881, page 50.
  - *Dentalium* (*Antalis*) *ceratum flavum*, new subspecies, page 51.
  - *Dentalium* (*Antalis*) *tenax*, new subspecies, page 52.
  - *Dentalium* (*Antalis*) *taphrium* Dall, 1889, page 53.
- Group of *D. bartletti:*
  - *Dentalium* (*Antalis*) *bartletti*, new species, page 55.
  - *Dentalium* (*Antalis*) *tubulatum*, new species, page 56.
- *Dentalium* (*Heteroschisma*) *callithrix* Dall, 1889, page 57.
- *Dentalium* (*Heteroschisma*) *subterfissum* Jeffreys, 1877, page 58.
- *Dentalium* (*Fissidentalium*) *amphialum* Watson, 1879, page 59.
- *Dentalium* (*Fissidentalium*) *meridionale* Pilsbry and Sharp, 1897, page 59.
- *Dentalium* (*Fissidentalium*) *meridionale meridionale* Pilsbry and Sharp, 1897, page 61.
- *Dentalium* (*Fissidentalium*) *meridionale jamaicense*, new subspecies, page 62.
- *Dentalium* (*Fissidentalium*) *meridionale verrilli*, new name, page 62.
- *Dentalium* (*Fissidentalium*) *floridense*, new species, page 64.
- *Dentalium* (*Graptacme*) *eboreum* Conrad, 1846, page 66.
- *Dentalium* (*Graptacme*) *circumcinctum* Watson, 1879, page 68.
- *Dentalium* (*Graptacme*) *semistriolatum* Guilding, 1834, page 69.
- *Dentalium* (*Graptacme*) *amaliense*, new species, page 71.
- *Dentalium* (*Graptacme*) *sericatum* Dall, 1881, page 71.
- *Dentalium* (*Graptacme*) *calamus* Dall, 1889, page 72.
- *Dentalium* (*Laevidentalium*) *callipeplum* Dall, 1889, page 74.
- *Dentalium* (*Laevidentalium*) *perlongum* Dall, 1881, page 75.
- *Dentalium* (*Laevidentalium*) *liodon* Pilsbry and Sharp, 1897, page 76.
- *Dentalium* (*Laevidentalium*) *liodon liodon* Pilsbry and Sharp, 1897, page 76.
- *Dentalium* (*Laevidentalium*) *liodon alloschismum* Pilsbry and Sharp, 1897, page 77
- *Dentalium* (*Episiphon*) *sowerbyi* Guilding, 1834, page 77.
- *Dentalium* (*Episiphon*) *sowerbyi sowerbyi* Guilding, 1834, page 79.
- *Dentalium* (*Episiphon*) *sowerbyi pelliceri*, new subspecies. page 80.
- *Dentalium* (*Bathoxiphus*) *ensiculus* Jeffreys, 1877, page 81.
- *Dentalium* (*Bathoxiphus*) *didymum* Watson, 1879, page 83.
- *Dentalium* (*Compressidens*) *pressum* Pilsbry and Sharp, 1897, page 83.
- *Dentalium* (*Compressidens*) *ophiodon* Dall, 1881, page 84.
- *Dentalium* (*Fustiaria*) *stenoschisum* Pilsbry and Sharp, 1897, page 86.
- *Entalina platamodes* Watson, 1879, page 87.
- *Entalina quadrata*, new species, page 88.
- *Siphonodentalium lobatum* Sowerby, 1860, page 89.
- *Siphonodentalium striatinum* new species, page 90.
- *Siphonodentalium tytthum* Watson, 1879, page 91.
- *Siphonodentalium verrilli*, new species, page 91.
- *Siphonodentalium* (*Pulsellum*) *occidentale*, new species, page 93.
- *Siphonodentalium* (*Pulsellum*) *bushi*, new species, page 94.
- *Cadulus* (*Polyschides*) *tetraschistus* Watson, 1879, page 97.
- *Cadulus* (*Polyschides*) *quadridentatus* Dall 1881, page 97.

Cadulus (*Polyschides*) *quadridentatus quadridentatus* Dall 1881, page 99.
Cadulus (*Polyschides*) *quadridentatus acompsus*, new subspecies, page 100.
Cadulus (*Polyschides*) *tetrodon* Pilsbry and Sharp, 1897, page 101.
Cadulus (*Polyschides*) *carolinensis* Bush, 1885, page 102.
Group of *C. grandis:*
  Cadulus (*Platyschides*) *grandis* Verrill, 1884, page 105.
  Cadulus (*Platyschides*) *spectabilis* Verrill, 1885, page 106.
  Cadulus (*Platyschides*) *elephas*, new species, page 107.
  Cadulus (*Platyschides*) *poculum* Dall, 1889, page 108.
  Cadulus (*Platyschides*) *aequalis* Dall, 1881, page 109.
Group of *C. agassizi:*
  Cadulus (*Platyschides*) *agassizii* Dall 1881, page 110.
  Cadulus (*Platyschides*) *catharus*, new species, page 112.
  Cadulus (*Platyschides*) *parvus*, new species, page 113.
  Cadulus (*Platyschides*) *foweyensis*, new species, page 114.
  Cadulus (*Platyschides*) *portoricensis*, new species, page 115.
Group of *C. pandionis:*
  Cadulus (*Platyschides*) *rushii* Pilsbry and Sharp, 1898, page 116.
  Cadulus (*Platyschides*) *rushii arne*, new subspecies, page 118.
  Cadulus (*Platyschides*) *pandionis* Verrill and Smith, 1880, page 118.
  Cadulus (*Platyschides*) *watsoni* Dall, 1881, page 120.
Cadulus (*Platyschides*) *vulpidens* Watson, 1879, page 121.
Cadulus *Platyschides*) *providensis*, new species, page 122.
Cadulus (*Platyschides*) *elongatus*, new species, page 122
Cadulus (*Platyschides*) *greenlawi*, new species, page 123
Cadulus (*Platyschides*) *arctus*, new species, page 124.
Cadulus (*Platyschides*) *braziliensis*, new species, page 124
Cadulus (*Platyschides*) *bushii* Dall, 1889, page 125.
Cadulus (*Platyschides*) *lunula* Dall, 1881, page 126.
Cadulus (*Platyschides*) *simpsoni*, new species, page 127.
Cadulus (*Platyschides*) *amiantus* Dall, 1881, page 128.
Cadulus (*Platyschides*) *nitidus*, new species, page 129.
Cadulus (*Platyschides*) *miamiensis*, new species, page 129.
Group of *C. sauridens:*
  Cadulus (*Gadila*) *sauridens* Watson, 1879, page 131.
  Cadulus (*Gadila*) *rastridens* Watson, 1879, page 132.
  Cadulus (*Gadila*) *mayori*, new species, page 133.
Group of *C. minusculus:*
  Cadulus (*Gadila*) *minusculus* Dall, 1889, page 134.
  Cadulus (*Gadila*) *iota*, new species, page, 134.
  Cadulus (*Gadila*) *subula* new species, page 135.
  Cadulus (*Gadila*) *verrilli*, new species, page 136.
  Cadulus (*Gadila*) *regularis*, new species, page 137.
  Cadulus (*Gadila*) *atlanticus*, new species, page 137.
Cadulus (*Gadila*) *cylindratus* Jeffreys, 1877, page 139.
Group of *C. acus:*
  Cadulus (*Gadila*) *acus* Dall, 1889, page 140.
  Cadulus (*Gadila*) *dominguensis* Orbigny, 1853, page 141.
Cadulus (*Cadulus*) *curtus* Watson, 1879, page 142.
Cadulus (*Cadulus*) *congruens* Watson, 1879, page 142.
Cadulus (*Cadulus*) *transitorius*, new species, page 143.
Cadulus (*Cadulus*) *transitorius barbadensis*, new subspecies, page 144.
Cadulus (*Cadulus*) *ampullaceus* Watson, 1879, page 144.
Cadulus (*Cadulus*) *exiguus* Watson, 1879, page 145.
Cadulus (*Cadulus*) *obesus* Watson, 1879, page 146.
Cadulus (*Cadulus*) *cucurbitus* Dall, 1881, page 146.

Cadulus (*Cadulus*) *platensis*, new species, page 147.
Cadulus (*Cadulus*) *podagrinus*, new species, page 148.
Cadulus (*Cadulus*) *halius*, new species, page 149.
Cadulus (*Cadulus*) *tersus*, new species, page 149.

GEOGRAPHICAL DISTRIBUTION.

The following table sets forth the geographical and depth ranges of all the species and subspecies enumerated in this paper. To interpret the records some allowance must be made for the meager information we possess in regard to many of the species. The area under consideration is very great, including many thousand miles of coast line and vast expanse of ocean, where the extremes of temperature and salinity are met. In all this diversified area but few rather restricted regions have been thoroughly explored. The entire coast from the Mississippi Delta to Colon and thence along the Caribbean shores of South America is almost unknown. The few records we have from its continental slope are insufficient for conclusive generalization. The number of dredge hauls from the entire South American coast is actually less than those made within a square of 20 or 30 miles off Cape Hatteras. The same is almost true of the archibenthal belt about the Antillean Islands. In the very few areas where intensive collecting has been done a number of Scaphopods have been discovered which, upon our range list, must appear to be as of a particular locality only, while some others connect specifically a thousand miles away without any intermediate record. Thus many vagaries of distribution are presented which would likely be explained away by a fuller knowledge of actual facts. Our table is truthful as far as it goes, but it can not always tell the whole truth.

A possible source of error may arise where the continental slope drops swiftly into profound depths, and especially where such declivities are swept by an oceanic current. This condition obtains off the Yucatan Banks, along the shores of Cuba, and probably in many other Antillean localities where steep depth gradients are the rule rather than the exception. Thus, species living near the upper edge of a continental slope (usually a rich life zone) may easily have their dead shells carried the few miles necessary to deposit them upon the ocean floor. Fish no doubt consume vast quantities of Scaphapods and occasionally eject their shells at considerable distances.

Despite the poverty of our data and the margin of error in our records it is, nevertheless, possible to draw some definite conclusions from the table.

1. A cold-water group (*D. stimpsoni*, *occidentale*, *georgiense*, *ensiculus*, and *S. lobatum*) belonging to a far northern range and all having East Atlantic affiliations, persist south of Cape Cod and occasionally even to Hatteras. In all such cases their station depths are sufficient to furnish the degree of cold necessary for their economy.

2. Of southern shallow and moderate depth forms but one (*C. agassizii*) passes Hatteras, and this along the Gulf Stream edge.

3. Many deep-water species have a very extensive southern range, but even in their cases Hatteras seems to form a recognizable barrier against northern migration. An exception is noted in *D. meridionale*, which, considered as a superspecies, extends from Brazil to Georges Banks, but in a least recorded depth of about 700 fathoms.

4. The majority of species enumerated belong to what might be called in broad terms an Antillean fauna. They are usually noted from more than one Antillean locality, and a large proportion of them appear along the Florida keys and the sweep of the Gulf Stream. Those Antillean species *not* found in the Florida Straits are of very restricted local distribution or belong to the greater depth zones.

5. A certain number of Florida Key species are not of Antillean range, but appear occasionally in the Gulf of Mexico and have a range northerly within the Gulf Stream influence to Hatteras. These seem to constitute a more strictly Floridian element.

6. A few species (*D. texasianum, pseudohexagonum, disparile, sericatum, liodon, C. acompsus, watsoni*, and *providensis*) seem to indicate a scheme of distribution which includes the mainland coast from Brazil to West Florida and the Carolinas, and excludes all the Antilles save Barbados; nor are they to be found in the Gulf Stream. Just how far such a faunal element may be differentiated is now unsafe to say in view of our imperfect knowledge of the area involved. There is a significance, however, in the present record, for it will also be noted that all our Brazilian records are only repeated in the Barbadian region, along the mainland shores and in the Gulf of Mexico, but not in the broad Antillean region, nor in the Gulf Stream. I exclude from these only the abyssal ocean floor species.

7. A false note is touched in an 11-fathom station off Rio de la Plata quoted four times in our table, and in each instance for deep-water species of other stations. I feel quite sure that some error has been made in recording this station (No. 2714) by the United States Fish Commission.

In conclusion, then, I would say we have to deal with two well-defined and clearly marked faunas—first, a northern cold-water group of close northern Europe affiliations, and extending from the New England region and its outer banks to Hatteras; second, an Antillean assemblage of very extensive range from Brazil to Hatteras, with the dominating influence of the currents entering the Caribbean from the Atlantic and debouching from the Gulf as the Gulf Stream as the main distributional force. Within this great area are likely certain well-marked subfaunal areas, two of which are recognizable from our table. One of these is a mainland coastal faunula and the other a Floridian element which includes the area bordering the inner edge of the Gulf Stream from lower Florida to Cape Lookout or Hatteras.

TABLE SHOWING HORIZONTAL AND

Name.	North Europe.	Arctic-Nova Scotia.	Maine-Cape Cod.	Outer N. Eng. Banks.	So. N. Eng., N. J., Md., Va.	Hatteras.	N. Car., S. Car., Ga.	Florida E. Coast.	Florida Keys.	Florida W. Coast.	Texas-Mexico.
D. laqueatum laqueatum						$\frac{49}{124}$			$\frac{24}{193}$	$\frac{60}{68}$	
D. l. regulare											
D. texasianum texasianum							$\frac{3}{9}$			*	*
D. t. cestum											*
D. t. rioense											
D. gouldii gouldii							12				
D. gouldii portoricense											
D. gouldii colonense											
D. rebeccaense										$\frac{7}{18}$	
D. obscurum											
D. carduus											
D. entale stimpsoni		$\frac{26}{150}$	$\frac{8}{106}$	$\frac{60}{1255}$	$\frac{41}{568}$	142					
D. agile subagile		$\frac{93}{134}$		57							
D. occidentale		$\frac{101}{103}$	$\frac{60}{175}$	$\frac{106}{1356}$	$\frac{28}{1081}$	$\frac{143}{843}$					
D. o. georgiense				1,255	$\frac{87}{1004}$	300					
D. antillarum									$\frac{2}{38}$	$\frac{2}{14}$	
D. pseudohexagonum										$\frac{2}{5}$	
D. disparile										*	
D. ceratum ceratum								294	$\frac{35}{90}$	$\frac{60}{321}$	
D. c. flavum									$\frac{22}{135}$		
D. c. tenax											
D. taphrium						22	$\frac{22}{52}$		$\frac{8}{60}$	30	
D. bartletti							(?)		$\frac{85}{193}$	$\frac{196}{539}$	
D. tubulatum								294			
D. callithrix							731			1,181	
D. amphialum											
D. meridionale meridionale											
D. mer. jamaicense											
D. mer. verrilli				$\frac{452}{1813}$	$\frac{705}{1537}$	$\frac{888}{938}$					
D. floridense									$\frac{35}{110}$		
D. eboreum						$\frac{7}{87}$	$\frac{3}{52}$		$\frac{18}{60}$	$\frac{2}{111}$	
D. circumcinctum											
D. semistriolatum									$\frac{15}{90}$	$\frac{7}{12}$	
D. amaliense											
D. sericatum											
D. calamus									$\frac{1}{23}$		
D. callipeplum										$\frac{111}{189}$	

BATHYMETRIC DISTRIBUTION.

Yucatan Banks.	Caribbean mainland.	Bermuda.	Bahamas.	Cuba.	Jamaica.	Haiti-Santo Dom.	Porto Rico-St. Thos.	Lesser Antilles.	Barbados.	Brazil—North.	Brazil—South.	Fernando Noronha.	Argentine.
				$\frac{118}{182}$			*	$\frac{54}{154}$	100				
					*			120	$\frac{73}{140}$				
	*												
											59		
							20						
	25												
									$\frac{82}{140}$				
			338					$\frac{116}{154}$	100				
			$\frac{0}{20}$	$\frac{1}{12}$				*					
										*			
	*							*		*	*		
84				$\frac{288}{400}$			97	120	$\frac{60}{100}$				
				25									
									$\frac{33}{199}$				
399				400				$\frac{357}{464}$					
				220									
				224				$\frac{880}{1391}$	671				(?)
													1,900
1,568											671		
					966					1,019			
									100				
						16	*	$\frac{1}{5}$					
		1,075						470		350			
		*	20	*		*	*	*	*				
							*						
640													
			$\frac{1}{5}$	$\frac{0}{6}$			12						
							25	$\frac{21}{116}$					

TABLE SHOWING HORIZONTAL AND

Name.	North Europe.	Arctic-Nova Scotia.	Maine-Cape Cod.	Outer N. Eng. Banks.	So. N. Eng., N. J., Md., Va.	Hatteras.	N. Car., S. Car., Ga.	Florida E. Coast.	Florida Keys.	Florida W. Coast.	Texas-Mexico.
D. perlongum						683				$\frac{940}{1181}$	
D. liodon liodon											
D. l. alloschismum											
D. sowerbyi sowerbyi						$\frac{49}{124}$	17		$\frac{8}{250}$	$\frac{28}{60}$	
D. s. pelliceri									65		
D. ensiculus				1,813	$\frac{1631}{1859}$			294	193	196	
D. didymum											
D. pressum								294	$\frac{100}{339}$		
D. ophiodon								294	$\frac{75}{100}$	169	
D. stenoschizum									110		
E. platamodes								294	430		
E. quadrata											
S. lobatum	*	*	60		$\frac{100}{1813}$	516					
S. striatinum								294			
S. tytthum											
S. verilli				$\frac{384}{1290}$							
S. occidentale					$\frac{86}{984}$						
S. bushi				499	$\frac{319}{984}$	516					
C. tetraschistus											
C. quadridentatus						$\frac{15}{22}$	$\frac{17}{52}$		$\frac{3}{50}$	$\frac{10}{26}$	
C. q. acompsus											
C. tetrodon							12		$\frac{2}{38}$		
C. carolinensis						$\frac{7}{63}$	$\frac{3}{52}$		$\frac{38}{60}$	$\frac{10}{30}$	
C. grandis				$\frac{906}{1290}$	$\frac{705}{1537}$	$\frac{843}{928}$					
C. spectabilis					$\frac{1467}{1859}$						
C. elephas											
C. poculum											
C. aequalis									339		
C. agassizii					70	$\frac{63}{124}$	$\frac{17}{159}$		$\frac{20}{217}$		
C. catharus											
C. parvus									$\frac{43}{90}$		
C. foweyensis									$\frac{55}{90}$		
C. portoricensis											
C. rushii				$\frac{328}{662}$	$\frac{238}{1537}$	$\frac{300}{843}$					
C. rushii arne					$\frac{197}{984}$						
C. pandionis					$\frac{35}{322}$				$\frac{25}{209}$		
C. watsoni											
C. vulpidens											

BATHYMETRIC DISTRIBUTION—continued.

Yucatan Banks.	Caribbean mainland.	Bermuda.	Bahamas.	Cuba.	Jamaica.	Haiti-Santo Dom.	Porto Rico-St. Thos.	Lesser Antilles.	Barbados.	Brazil—North.	Brazil—South.	Fernando Noronha.	Argentine.
								$\frac{121}{880}$		1,109	20?		11?
	*							200	80				
								*					
									$\frac{25}{90}$				
25				$\frac{1}{12}$									
640				1,024				$\frac{464}{496}$					
25							390		$\frac{12}{100}$				
				413			390						
				$\frac{220}{287}$					$\frac{110}{140}$				
							*		100				
							390						
								161					
							390						
												25	
25			$\frac{3}{20}$	$\frac{3}{25}$				2	$\frac{6}{12}$				10
	*												
		$\frac{3}{20}$											
								464					
640								464					
								120					
1,002								120	$\frac{33}{100}$				
							25						
413	382												
							390						

TABLE SHOWING HORIZONTAL AND

Name.	North Europe.	Arctic-Nova Scotia.	Maine-Cape Cod.	Outer N. Eng. Banks	So. N. Eng., N. J., Md., Va.	Hatteras.	N. Car., S. Car., Ga.	Florida E. Coast.	Florida Keys.	Florida W. Coast.	Texas-Mexico.
C. providensis								294			
C. elongatus										68	
C. greenlawi									130		
C. arctus										60	
C. braziliensis											
C. bushii											
C. lunula											
C. simpsoni											
C. amiantus											
C. nitidus											
C. miamiensis							294		$\frac{85}{209}$		
C. sauridens											
C. rastridens							440	294			
C. mayori									$\frac{16}{100}$	60	
C. minusculus						63					
C. iota									$\frac{37}{45}$		
C. subula											
C. verrilli					$\frac{110}{115}$						
C. regularis							440	$\frac{294}{309}$			
C. atlanticus					$\frac{428}{1081}$	$\frac{516}{843}$					
C. cylindratus					$\frac{1525}{1608}$						
C. acus								294			
C. dominguensis											
C. curtus											
C. congruens											
C. transitorius								$\frac{294}{304}$	$\frac{90}{175}$	$\frac{169}{196}$	
C. t. barbadensis											
C. ampullaceus											
C. exiguus											
C. obesus								294			
C. cucurbita											
C. platensis							440	294			
C. podagrinus											
C. helius											
C. tersus											

Figures are in fathoms; when in form of a fraction the enumerator represents the least recorded and
without depth record.

BATHYMETRIC DISTRIBUTION—continued.

Yucatan Banks.	Caribbean mainland.	Bermuda.	Bahamas.	Cuba.	Jamaica.	Haiti-Santo Dom.	Porto Rico-St. Thos.	Lesser Antilles.	Barbados.	Brazil—North.	Brazil—South.	Fernando Noronha.	Argentine.
.....	$\frac{294}{382}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
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.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59	.....	.....
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.....	.....	.....	.....	805	.....	.....	.....	.....	70	.....	.....	.....	.....
.....	.....	.....	.....	100	.....	.....	25	120	.....	.....	.....	.....	.....
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.....	.....	.....	.....	.....	.....	30	25	.....	.....	.....	.....	.....	.....
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.....	.....	.....	.....	.....	.....	.....	390	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	390	.....	.....	.....	.....	.....	.....
.....	382	.....	660	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	$\frac{80}{100}$	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	390	.....	.....	.....	.....	.....	.....
.....	.....	.....	*	.....	.....	.....	390	.....	100	.....	.....	.....	.....
.....	.....	.....	.....	220	.....	.....	390	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	310	.....	.....	.....	.....	*	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,019	.....	.....	11?
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.....	.....	.....	.....	.....	.....	.....	.....	120	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	$\frac{33}{75}$	.....	.....	.....	.....

the denominator the greatest recorded depths. An asterisk indicates occurrence of the species but

SYSTEMATIC CONSIDERATION OF THE SPECIES.[1]

Genus DENTALIUM Linnaeus.

Subgenus DENTALIUM Linnaeus, 1758.

1758. *Dentalium* Linnaeus, Syst. Nat., ed. 10, p. 785.

Type.—D. elephantinum Linnaeus.

Tip polygonal; in the American species observed clearly hexagonal or if obscurely angled then giving rise to 9, 10, or 12 primary longitudinal ribs usually increased by intercalation of secondary ribs to a total rarely exceeding 20 altogether. The ribs are usually well developed and prominent, especially upon the posterior portion of the shell. Microscopic sculpture including both longitudinal and transverse series may or may not exist. Apical features are generally wanting but in some species a slight notch is observable on the convex side.

The shells of this subgenus are medium to fairly large in size—from 21 to 89 mm. in American forms.

The line of differentiation between this and the next subgenus—*Antalis* is ill defined. In general the latter group includes smaller and less obviously sculptured shells. The American species of *Dentalium* may be roughly grouped into those of 6 primary ribs and those of more than 6, and also those with and those without microscopic sculpture.

KEY TO THE SPECIES OF THE SUBGENUS DENTALIUM.

- Tip section hexagonal.
  - Intercostal spaces smooth.
    - Ribs rod-like and slender.............................*texasianum*, page 27.
      - Intercalated ribs few.
        - Intercostal spaces flat..............*texasianum texasianum*, page 28.
        - Intercostal spaces rounded.............*texasianum rioense*, page 29.
      - Intercalated ribs numerous.................*texasianum cestum*, page 29.
    - Ribs not rod-like, broader ....*rebeccaense*, page 31.
  - Intercostal spaces not smooth.
    - Intercostal spaces microscopically engraved...............*gouldii*, page 29.
      - Shell strongly curved.
        - Intercalated secondary ribs present.....*gouldii colonense*, page 31.
        - Intercalated secondary ribs absent...*gouldii portoricense*, page 30.
      - Shell not strongly curved.....................*gouldii gouldii*, page 30.

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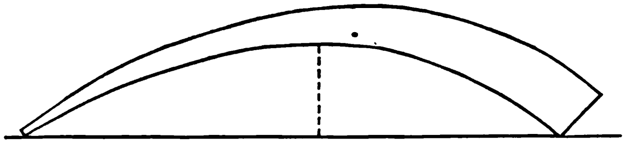
[1] In the description of species following the word "posterior" refers to that portion of the shell near the smaller or pointed end; "anterior" to that portion of the shell near the aperture or larger end. The "primary" ribs or riblets are the first or original longitudinals appearing on the tip of the shell; the "secondary" ribs or riblets are those later appearing or intercalated between the "primaries." The "arc" of the shell is a measure of curvature determined by the distance in millimeters from a line connecting the apex and aperture to the highest point above it in the concave arch of the shell. The drawing shows this more clearly than words.



Tip section not hexagonal.
  Primary ribs 9 ....*obscurum*, page 32.
  Primary ribs more than 9.
    Intercostal sculpture of transverse riblets..................*carduus*, page 33.
    Intercostal sculpture of latticed design.................*laqueatum*, page 23.
      Sculpture becoming obsolete near aperture.*laqueatum laqueatum*, page 24.
      Sculpture not becoming obsolete near aperture.*laqueatum regulare*, p. 26.

DENTALIUM (DENTALIUM) LAQUEATUM Verrill.

1885. *Dentalium laqueatum* VERRILL, Trans. Conn. Acad. Arts Sci., vol. 6, pt. 2, p. 431, pl. 44, fig. 18.
1889. *Dentalium laqueatum*, DALL, Bull. Mus. Comp. Zool., vol. 18, pt. 2, p. 426, pl. 27, fig. 1.
1889. *Dentalium laqueatum*, DALL, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 1; pl. 46, fig. 18.
1897. *Dentalium* (*Dentalium*) *laqueatum*, PILSBRY and SHARP, Tryon's Manual of Conch., vol. 17, p. 10, pl. 7, figs. 1, 2; pl. 5, fig. 73.

The shell is large with a maximum length and diameter of 62 by 6½ mm., rather thick, strong, gently curved, the tip being sharply curved. The tip is nine angled, quickly tapering; the balance of the shell only moderately so. Adult specimens are always without tips. Occasionally the shell is slightly flattened dorso-ventrally.

The color is dull white, opaque, neither glassy nor chalky. Nearly all the National Museum specimens are black stained on the posterior portion of the shell.

The sculpture consists of 9 to 12 strong elevated primary longitudinal ribs, with about equally spaced concave intercostal spaces. The ribs become broader and less elevated in about the middle portion of an adult shell, while the spaces between them become wider and flatter, with but slight intercalation of less important secondary ribs. On the anterior third the ribs degenerate into a rather smooth surface, or sometimes persist to the aperture. Over all the shell surface, including the ribs, is spread a finely reticulated sculpture, becoming only less apparent on the extreme anterior portion, or where worn off on the rib summits.

An apical notch on the convex side sometimes extends into a fairly long slit, but these apical characters are often quite obliterated.

Length, 45 mm., diameter, 6 mm. (Verrill, type).

Length, 51 mm., diameter, 6 mm., arc 1 (without tip).

Length, 55 mm., greater diameter, 6 mm., lesser diameter, 5.5 mm.

Length, 62 mm., greater diameter, 6.5 mm., lesser diameter, 6.5 mm.; arc, 1.5 (no tip).

Tips are easily recognizable, aside from their sculpture, by rapid increase in diameter, their sharp curve and the fluted peristome, the primary sculptural features being repeated on the inside of the shell. The nepionic tip is preserved in a Barbadian specimen which merits a description. The extreme end is bulbous, with a flaring opening which is somewhat produced or drawn out, and is perfectly smooth, exceedingly thin, and glassy. This bulbous portion of about 0.2 mm. length is followed by a constricted neck of about 0.2 mm. length, around which are several prominent growth bands. Following this constricted neck the shell begins its normal increase in girth as an exceedingly fragile round tube 1 mm. long, upon which appear faintly the beginnings of the primary ribs. These ribs increase in definiteness until the shell loses its round section and becomes polygonal in form. These primaries show a minute serration even before the interspaces assume their characteristic transverse sculpture. All of the portion so described, which measures about 3 mm. in length, is broken off and lost except in very rare instances. A normal tip measurement is: Length, 25 mm., diameter, 4 mm., with an arc of 3.1.

Variations are slight and may be referred chiefly to the degree of persistence shown by the primary ribs before they become flattened and finally merged into the smoothish anterior portion.

The type, Cat. No. 44671, U.S.N.M., was dredged at United States Bureau of Fisheries Station 2268 off Cape Hatteras, in 68 fathoms, gray mud, bottom temperature 71.3° F.

The extensive series in the National Museum collection shows extremes of depth from 10 to 193 fathoms and ranging from the Hatteras region to Barbados, including the Gulf of Mexico. It appears to be a very abundant species in the sandy mud ("green mud") along the inner edge of the Gulf Stream in the Florida Keys region, especially from off Fowey Light and Cape Florida.

It is an exceedingly well-marked species of very definite characters and not easily to be confused with any other species of the western Atlantic. Two subspecies are indicated.

DENTALIUM (DENTALIUM) LAQUEATUM LAQUEATUM Verrill.

Plate 1, figs. 6 and 7.

This subspecies includes the forms presenting the sculptural features described under *D. laqueatum* (p. 23) as losing distinctness and form in the anterior portion of the shell. All the sculptural elements of this species, consisting of primary and secondary ribs and a finely reticulated surface covering both the ribs and the spaces between them, become gradually merged into a smooth though not a polished surface. The type is the same as of *D. laqueatum*.

The following lots are in the United States National Museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	44671	Cape Hatteras, U. S. B. F. Station 2268	68 fms., gray mud, 71.3° (type).
44	93100	Cape Hateras, U. S. B. F. Station 2592	120 fms., fine gray sand, 58°.
6	93101	Cape Hatteras, U. S. B. F. Station 2596	49 fms., gray sand, 75°.
66	93102	Cape Hatteras, U. S. B. F. Station 2595	63 fms., sand, 75°, gray sand, broken sh.
4	93103	Cape Hatteras, U. S. B. F. Station 2600	87 fms., sand, 71.5° fine 97.3 broken sp broken sh.
1	93104	Cape Hatteras, U. S. B. F. Station 2602	124 fms., sand, 61° s. r.
3	93105	Cape Hatteras, U. S. B. F. Station 2603	124 fms., sand, s. r.
22	329529	Cape Hatteras, U. S. B. F. Station 2595	63 fms., gy s., brk. sh.
9	329902	Cape Hatteras, U. S. B. F. Station 2600	87 fms., gy. s. bk. sp. brk. sh 71.5°.
4	92822	Cape Florida, U. S. B. F. Station 2648	84 fms , gy. m.
4	314201	Miami, Florida, *Eolis* Station 14	40 fms.
4	314202	Fowey Light, *Eolis* Station 184	48 fms., s.
26	314203	Ragged Key, Florida, *Eolis* Station 190	70 fms., s.
18	314204	Ragged Key, Florida, *Eolis* Station 194	85 fms., fne. s.
18	314205	Fowey Light, *Eolis* Station 172	55 fine s.
18	314206	Fowey Light, *Eolis* Station 147	35 fms., crs. s.
1	330523	Cape Florida, U. S. B. F. Station 2644	193 fms., gy. s., 43.4°.
15	314207	Ragged Key, Florida, *Eolis* Station 166	65 fms.
14	314208	Fowey Light, Florida, *Eolis* Station 182	75 fms., s.
20	314209	Ragged Key, Florida, *Eolis* Station 191	71 fms., s.
14	314210	Miami, Florida, *Eolis* Station 113	18–20 fms., s.
16	314211	Fowey Light, Florida, *Eolis* Station 104	50 fms., s.
15	314212	Fowey Light, Florida, Station 354	80 fms., s.
33	314213	Sand Key, Florida, *Eolis* Station 56	70 fms., s.
16	314214	Fowey Light, Florida, *Eolis* Station 178	68 fms., s.
24	314215	Fowey Light, Florida, *Eolis* Station 170	53 fms., s.
16	314216	Fowey Light, Florida, *Eolis* Station 156	47 fms., s.
14	314217	Fowey Light, Florida, *Eolis* Station 168	65 fms., s.
29	314218	Fowey Light, Florida, *Eolis* Station 167	65 fms., s.
15	314219	Miami, Florida, *Eolis* Station 87	63 fms., s.
5	314220	Miami, Florida, *Eolis* Station 68	45 fms., s.
19	314221	Fowey Light, Florida, *Eolis* Station 176	52 fms., s.
20	314222	Fowey Light, Florida, *Eolis* Station 165	78 fms., s.
11	314223	Fowey Light, Florida, *Eolis* Station 181	71 fms., s.
10	314224	Fowey Light, Florida, *Eolis* Station 180	76 fms., s.
16	314225	Fowey Light, Florida, *Eolis* Station 173	58 fms., s.
20	314226	Fowey Light, Florida, *Eolis* Station 309	60 fms., s.
6	314227	Fowey Light, Florida, *Eolis* Station 92	45 fms., s.
16	314228	Fowey Light, Florida, *Eolis* Station 153	
30	314229	Fowey Light, Florida, *Eolis* Station 177	60 fms., s.
23	314230	Fowey Light, Florida, *Eolis* Station 151	55 fms., s.
16	314231	Fowey Light, Florida, *Eolis* Station 308	65 fms., s.
25	314232	Fowey Light, Florida, *Eolis* Station 307	70 fms., s.
31	314233	Fowey Light, Florida, *Eolis* Station 175	60 fms., s.
3	314234	Fowey Light, Florida, *Eolis* Station 109	40 fms., s.
17	314235	Fowey, Florida, *Eolis* Station 130	25 fms., s.
14	314236	Miami, Florida, *Eolis* Station 116	65 fms., gn. m.
5	314237	Fowey, Florida, *Eolis* Station 76	40 fms., s.
19	314238	Fowey Light, Florida, *Eolis* Station 174	58 fms., s.
19	314239	Fowey Light, Florida, *Eolis* Station 148	38 fms., s.
13	314240	Fowey Light, Florida, *Eolis* Station 152	40 fms., s.
12	314241	Fowey Light, Florida, *Eolis* Station 155	43 fms., s.
12	314242	Fowey Light, Florida, *Eolis* Station 179	70 fms., s.
7	314243	Fowey Light, Florida, *Eolis* Station 171	53 fms., s.
46	314244	Fowey Light, Florida, *Eolis* Station 169	70 fms., s.
14	314245	Miami, Florida, *Eolis* Station 138	60 fms., s.
17	314246	Cape Florida, *Eolis* Station 189	67 fms., s.
22	314247	Fowey, Florida, *Eolis* Station 186	68 fms., s.
15	314248	Fowey Light, Florida, *Eolis* Station 184	48 fms., s.
12	314249	Miami, Florida, *Eolis* Station 48	60 fms., s.
3	314250	Fowey Light, Florida, *Eolis* Station 104	50 fms., s.
11	314251	Fowey Light, Florida, *Eolis* Station 154	42 fms., s.
1	314252	Miami, Florida, *Eolis* Station 125	30 fms., s.
9	314253	Fowey, Florida, *Eolis* Station 120	25 to 30 fms., s.
27	314254	Fowey Light, Florida, *Eolis* Station 355	70 fms., s.
4	314255	Ragged Key, Florida, *Eolis* Station 192	75 fms., s.
1	314256	Caesars Creek Bank, *Eolis* Station 40	10 feet s.
2	314257	Miami, Florida, *Eolis* Station 51	24 fms., s.
24	314258	Fowey Light, Florida, *Eolis* Station 352	90 fms., s.
3	314259	Ragged Key, Florida, *Eolis* Station 191	71 fms., s.
1	314260	Miami, Florida, *Eolis* Station 68	45 fms., s.
1	97178	Cape Florida, Florida, U. S. B. F. Station 2646	85 fms., gy. s. for.
5	314261	Long Reef, Florida, *Eolis* Station 145	40 fms., s.
8	314262	Long Reef, Florida, *Eolis* Station 136	58 fms., s.
9	314263	Ajax Reef, Florida, *Eolis* Station 137	40 fms., s.
11	314264	Ajax Reef, Florida, *Eolis* Station 370	70 to 90 fms., s.
15	314265	Ragged Key, Florida, *Eolis* Station 365	75 fms., s.
8	314266	Ajax Reef, Florida, *Eolis* Station 368	100 to 180 fms., gn. m.
4	330428	Carysfort Light, Florida, U. S. B. F. Station 2641	60 fms., co. s., 69.2°
2	314267	Western Dry Rocks, Florida, *Eolis* Station 321	65 fms.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	314268	Miami, Florida, *Eolis* Station 48	60 fms., gn m.
1	314269	Fowey Light, Florida, *Eolis* Station 174	58 fms., s,
13	314270	Sambo Reef, Florida, *Eolis* Station 196	58 fms., s.
4	314271	Sambo Reef, Florida, *Eolis* Station 195	50 fms., s.
1	314272	Sand Key, Florida, *Eolis* Station 3	69 fms., s. br. sh.
37	314273	Sand Key, Florida, *Eolis* Station 32	61 fms., s.
3	314274	Sand Key, Florida, *Eolis* Station 161	76 fms., s.
65	314275	Sand Key, Florida, *Eolis* Station 160	62 fms., s.
42	314276	Sand Key, Florida, *Eolis* Station H	60 to 65 fms., s.
1	314277	Key West, Florida, *Eolis* Station 44	50 fms., s.
35	314278	Key West, Florida, *Eolis* Station 43	63 fms., s.
3	314279	Sand Key, Florida, *Eolis* Station 98	70 to 90 fms., s.
5	314280	Key West, Florida, *Eolis* Station 5	60 fms., s.
2	314281	Key West, Florida, *Eolis* Station 1	55 fms., s.
1	314282	Sand Key, Florida, *Eolis* Station 323	110 fms.
1	95333	Sand Key, Florida, *Bibb* Station	120 fms. (Pourtales).
10	314283	Key West, Florida, *Eolis* Station 38	
41	314284	Sand Key, Florida, *Eolis* Station 32	61 fms., s.
11	314285	Sand Key, Florida, *Eolis* Station 159	58 fms., s.
17	314286	Sand Key, Florida, *Eolis* Station 32	61 fms., s.
3	314287	Sand Key, Florida, *Eolis* Station, 31	90 fms., s.
9	314288	Sand Key ,Florida, *Eolis* Station 300	72 fms., s.
3	314289	Key West, Florida, *Eolis* Station 43	63 fms., s.
3	181153	Tortugas, Florida, U. S. C. S. Station 26	110 fms., s.
3	323957	Cape San Blas, Florida, U. S. B. F. Station 2404.	60 fms., gy. s.
2	323597	Mississippi River (off), U. S. B. F. Station 2378 .	68 fms., gy. m.
2	323985	Gulf of Mexico, U. S. B. F. Station 2404	60 fms., gy. s.
1	93956	Off Habana, Cuba, U. S. B. F. Station 2327	182 fms., per br. s.
1	93820	Off Habana, Cuba, U. S. B. F. Station 2337	199 fms., co.
3	95334	Off Habana, Cuba, U. S. C. S. Station	119 fms.
13	95336	Off Sombrero, U. S. C. S. Station 5	54 fms.
1	94114	St. Thomas, West Indies	Shore.
1	95337	Grenada, U. S. C. S. Station 246	154 fms. dk. gy. oz.
6	95335	Barbados U. S. C. S. Station	100 fms,

DENTALIUM (DENTALIUM) LAQUEATUM REGULARE, new subspecies.

Plate 1, fig. 8.

Four lots in the National Museum collection from Jamaica and Barbados carry the ribs without change, even in fully adult specimens, to the oral end of the shell. The 12 ribs in the specimen selected as a type are prominent and are neither modified nor flattened at their termination in the aperture rim of the shell. The fine reticulation and all other features remain as in typical forms (*Dentalium laqueatum laqueatum*).

The type, Cat. No. 107887, U.S.N.M., measuring 40.5 mm. in length and 5.5 mm. in diameter, was collected by C. B. Adams in Jamaica, without depth record.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	107887	Jamaica (C. B. Adams)	
4	314885	Antigua, S. U. I. Expedition Station 115	120 fms., sd.
1	95339	Barbados, U. S. C.S. Station 293	81 fms., co. s. 64.5°
3	95340	Barbados, U. S. C. S. Station 296	85 fms., hrd. s. 61.5°
1	95338	Barbados, U. S. C. S. Station 290	73 fms., co., s. sh. $70\frac{3}{4}$°
3	314886	Barbados, S. U. I. Expedition Station 60	110 fms.
2	314887	Barbados, S. U. I. Expedition Station 10	100 fms.
1	314888	Barbados, S. U. I. Expedition Station 40	90 fms.
1	314889	Barbados, S. U. I. Expedition Station 44	90–100 fms.
5	314890	Barbados, S. U. I. Expedition Station 38	140 fms. (fragments and tips).
1	314891	Barbados, S. U. I. Expedition Station —	— fms. (tip).

[1] Type.

DENTALIUM (DENTALIUM) TEXASIANUM Philippi.

(?)1843. *Dentalium americanum* Chenu, Conch. Ill., vol. 1, p. 1, pl. 4, figs. 9, 10 (all subsequent references in European literature).

(?)1843. *Dentalium americanum* var. *c*, Chenu, Conch. Ill., vol. 1 (index), pl. 6, fig. 35 (not pl. 4, figs. 9, 10).

1848. *Dentalium texasiana* Philippi, Zeitschr. Malak., p. 144.

1878. *Dentalium sexangulare* Hilgard and Hopkins, Report Borings Miss. River, and Lake Borgue, Engineer's Dept., U. S. A., p. 48, pl. 3, fig. 7 (not of Lamarck).

1889. *Dentalium gouldii* Dall, Bull. Mus. Comp. Zool., vol. 18, pt. 2, p. 424 (not pl. 27, fig. 4), in part.

1889. *Dentalium gouldii* Dall, Bull. 37, U. S. Nat. Mus., p. 76, in part (not fig.).

1896. *Dentalium gouldii* Guppy and Dall, Proc. U. S. Nat. Mus., vol. 19, p. 325, in part.

1897. *Dentalium* (*Dentalium*) *texasiana*, Pilsbry and Sharp, Tryon's Man. of Conch., vol. 17, p. 22.

1897. *Dentalium gouldii*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 20 (not pl. 7, fig. 14), in part.

1903. *Dentalium gouldii* Dall, Bull. 37, Reprint, U. S. Nat. Mus., p. 76, in part.

The following essential features are taken from topotypes in the National Museum collection.

The shell is rather strongly curved in the posterior portion, but less so anteriorly; very slowly increasing in diameter. It is hexagonal in section; dull gray-white in color, not glassy or porcellanous, but opaque, solid and strong. The tip is hexagonal, the angles soon becoming narrow rod-like ribs, separated by wide, flat interspaces, smooth save for ill-defined widely separated growth lines or wrinkles. Intercalation of one or two, rarely three, longitudinal riblets may or may not take place. The ribs persist to the end, though less definitely marked anteriorly, but the shell often preserves the hexagonal section throughout. When greater intercalation is present the hexagonal section is less obvious at the oral aperture. In senile specimens all sculptural features may be almost lost at the extreme anterior end the shell then becoming a roughly rounded cylinder. The growth lines are more prominent in the anterior portion of the shell, almost attaining the importance of transverse sculpture. The apical characters remain doubtful; none of the museum specimens show either notch or slit. Many specimens have a projecting tube from the posterior orifice, but this is not a specific character.

Length, 31 mm., diameter, 2 mm. (composite specimen made up of tip and fragment), Sanibel Island, Florida.

Length, 21 mm.; diameter, 2 mm.; arc, 1.5, Sanibel Island, Florida (without tip).

Topotypes, Cat. Nos. 125552 and 134447, U.S.N.M. (Galveston).

Although Philippi's description is very brief, his definite locality of "Galveston" makes it possible to utilize his short diagnosis with reasonable certainty. The figures of Chenu seem to indicate this shell, but as they are accompanied by insufficient description and with vague or no locality data, I deem it best to set them aside with a query. The same reasons would apply for discarding *Dentalium pictei* Deshayes, a manuscript name. They probably represent some form of this group of which *D. texasianum* stands as a sort of super species. Doctor Dall and Doctor Pilsbry have occasionally confused this shallow water species with the former's *D. gouldii*, a closely allied species.

The inclusion of Brazilian specimens with a Texan type and North Carolina typical specimen seems questionable, but the evidence offered by the shells themselves is supplemented by the specific identity of many other mollusks from these relatively distant points. Nor is it entirely strange that the Florida Keys region and Antilles should have contributed no examples.

Some geographical races of this widely distributed species seem to be indicated.

DENTALIUM (DENTALIUM) TEXASIANUM TEXASIANUM Philippi.

Plate 1, figs. 2, 4, 5, and 9.

The shell is characterized by the flat, broad intercostal spaces in which the minimum of intercalation takes place—often none whatever. This form is from Texas, Louisiana, West Florida, North Carolina, and probably has a range from Yucatan to North Carolina, exclusive of the Florida Keys and Florida east coast.

Specimens from Pass Cabello, Texas, Cat. No. 159503, U.S.N.M., collected by J. D. Mitchell, without data, measure:

Length, 24 mm.; diameter, 2 mm.

Length, 20 mm.; diameter, 2 mm.

The following are the museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	314290	Beaufort Harbor Fish Commission, North Carolina, Station D. 7930.	4 fms., S. (August, 1913).
14	314291	Off Beaufort, North Carolina, *Eolis* Station 21	6–9 fms., S.
1	314292	Cape Lookout Bight, North Carolina, Station 20	3 fms.
50	228739	Sanibel Island, Florida	(W. F. Clapp.)
1	177962	Cameron, Louisiana	(R. P. Cowles.)
4	125552	Galveston and Corpus Christi, Texas	(Singley.)
2	134447	Galveston Bay, Texas	Do.
4	159503	Pass Cabello, Texas	(Mitchell.)
8	314839	Inlet Channel, opposite Perry's Island	Fish Commission.

DENTALIUM (DENTALIUM) TEXASIANUM CESTUM, new subspecies.

Plate 2, figs. 1, 4, 8.

The shell is characterized by an abundant intercalation of rather heavy cord-like riblets, which assume equal importance with the primaries and in the mature and senile stages obscure the hexagonal section of the shell.

The type, Cat. No. 159503 (*a*), U.S.N.M., is from Pass Cabello, Texas. It measures 18 mm. in length, with a diameter of 2 mm., and was collected by J. D. Mitchell. It is the only specimen of the lot and is without station data. It is probably a beach specimen and of very shallow depth range.

DENTALIUM (DENTALIUM) TEXASIANUM RIOENSE, new subspecies.

Plate 2, figs. 2, 3.

The shell is characterized by its rounded smooth intercostal spaces and by little or no intercalation of secondary ribs. The primary six rod-like ribs are even more slender and delicate than in the subspecies *D. t. texasianum.*

The type, Cat. No. 96114, U.S.N.M., measures: Length, 17.2 mm.; diameter, 1.5 mm. It is from east of Rio de Janeiro, at U. S. B. F. station 2762, in 59 fathoms, blue mud, bottom temperature 57.1° F., from a lot of 12 specimens.

There are also four specimens from the same original lot, Cat. No. 203143, U.S.N.M.; also one specimen, Cat. No. 150784, U.S.N.M., from San Sebastian, Brazil, presented by Ihering without additional data.

DENTALIUM (DENTALIUM) GOULDII Dall.

1889. *Dentalium gouldii* Dall, Bull. Mus. Comp. Zool., vol. 18, pt. 2, p. 424, in part.
1889. *Dentalium gouldii* Dall, Proc. U. S. Nat. Mus., vol. 12, p. 295, in part.
1889. *Dentalium gouldii* Dall, Bull. 37, U. S. Nat. Mus., p. 76, in part.
1896. *Dentalium gouldii*, Guppy and Dall, Proc. U. S. Nat. Mus., vol. 19, p. 325, in part.
1897. *Dentalium* (*Dentalium*) *gouldii*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 20, not pl. 7, fig. 14, in part.

The shell is hexagonal, slightly curved, regularly tapering and solid; white, vitreous, polished, and shining. It is six-angled at the apex, the angles becoming narrow, pinched-up, rod-like ribs, separated by broad flat spaces. Between these spaces are microscopically fine engraved longitudinal lines, more or less apparent, about 16 in the space of 1 mm., extending from the apex over about one-fourth the length of the shell and then terminating quite suddenly; the intercostal surfaces thereafter are smooth and polished with some transverse growth line scratches. The primary ribs become less defined anteriorly, but the hexagonal section is usually preserved, though not so distinctly at the aperture. There is no intercalation of secondary ribs except in one form, later described. No apical features are shown in any National Museum specimens.

The type, Cat. No. 82997, U.S.N.M., measures: Length, 29 mm.; diameter, 2.75 mm.; arc, 1 (tip gone); and is from 12 miles east of Frying Pan Shoals in 12 fathoms. It was collected by Doctor Rush, who has given no further data.

The glossy hyaline surface, the fine longitudinal engraved lines, and the general faces of this shell separate it from *D. texasianum.* It is apparently a moderate depth species. Three subspecies are indicated by the National Museum material.

The very few records in the National Museum collection, which are particularly referred to under the subspecific headings, indicate this to be a species of wide Antillean and Gulf Stream range, but not an abundant one at any known station.

DENTALIUM (DENTALIUM) GOULDII GOULDII Dall.

Plate 2, figs. 6, 7.

This subspecies, answering the original description of Doctor Dall for *Dentalium gouldii,* may be characterized by the well-marked microscopic sculpture within the intercostal spaces of its shell; by its straight outline, and the complete absence of any intercalation of secondary ribs. The intercostal sculpture, consisting of longitudinal lines, is sufficiently marked to be visible to the unaided eye.

The single specimen in the National Museum collection is the type referred to in the description of *D. gouldii,* next preceding. As this particular form of *D. gouldii* has not appeared at any of the many Florida shallow dredging stations it is undoubtedly a form of narrow geographical range and confined to the inner Gulf Stream edge off the Carolinas and Georgia.

DENTALIUM (DENTALIUM) GOULDII PORTORICENSE, new subspecies.

Plate 2, fig. 5.

1901. *Dentalium gouldii* Dall and Simpson, U. S. Fish. Comm. Bull. 1, 1900, p. 455.

The shell is hexagonal, thin but strong, vitreous, with a polished surface; the ribs are narrow and rod-like, separating broad flat spaces, which lack the clearly defined, very fine longitudinal lines of *D. g. gouldii,* although in oblique light they may be detached by use of a strong lens. The ribs become less defined anteriorly, while the intercostal spaces become convex, both finally merging in senile specimens into a round cylinder, the merest traces of the ribs remaining visible at the aperture. No intercalation of secondary ribs is shown. The apical characters are uncertain. The curvature of the shell is greater than in the typical subspecies and is uniform throughout the entire length of an adult shell.

The type, Cat. No. 161568, U.S.N.M., measures: Length, 42 mm.; diameter, 3 mm.; arc, 4 (without tip). It is from Mayaguez Harbor, Porto Rico, U. S. B. F. Station 6062, in 25 to 30 fathoms, on bottom of sand mud and shells, bottom temperature 75.8° F. Another lot of two young specimens, Cat. No. 161567, U.S.N.M., is from the same station.

DENTALIUM (DENTALIUM) GOULDII COLONENSE, new subspecies.

Plate 3, fig. 6.

1889. *Dentalium gouldii* DALL, Bull. Mus. Comp. Zool., vol. 18, p. 424, in part.
1897. *Dentalium gouldii*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 20, in part.

The shell is highly polished, glassy, thin but strong, milky white, and of fairly even curvature. The apical fifth is hexagonal with ribs very narrow and rod-like, giving wide intercostal spaces which show evanescent microscopic longitudinal engraved lines, less distinct than in *D. g. gouldii* but more so than in *D. g. portoricensis*. In the second fifth from the apex intercalation of one secondary rib between each two primaries begins and later additions confuse the hexagonal section of the shell. All ribs tend to decrease, and the anterior third of the shell is round, smooth, and vitreous, no trace of any sculpture remaining. No notch or slit is shown in the National Museum specimen.

The type, Cat. No. 94085, U.S.N.M., measures: Length 35 mm.; diameter, 2.75 mm.; arc, 2; was dredged at the U. S. B. F. Station 2145, near Colon, in 25 fathoms, on green mud and broken shells, no bottom temperature record being given. The type is the unique specimen.

This shell differs from the typical subspecies in the lesser development of all the sculptural characters, and again in the intercalation of secondary ribs, and finally in its degree of curvature.

DENTALIUM (DENTALIUM) REBECCAENSE, new species.

Plate 3, fig. 2.

Two lots in the National Museum collection belonging to the group of hexagonal tip species resist identification with any of the published forms. The specimens are all juvenile, but I am sufficiently convinced they are new to venture upon a description, even though the adult characters can not be given.

The shell is hexagonal, with a very attenuate and sharply curved tip, the six angles quickly assuming the character of pinched-up rounded ribs, separating rather broad, not quite flat intercostal spaces. No fine sculpture is indicated, but lines of opacity in a portion of the spaces between the ribs sometimes simulate a very close transverse system of lirae. There is no intercalation of secondary ribs in these thin, white juvenile specimens, nor notch nor other apical characters observable.

The type, Cat. No. 314293, U.S.N.M., measures: Length, 13 mm.; diameter, 1.75 mm.; arc, 1. It was dredged between Tortugas and Rebecca Shoals, Florida, in 16 fathoms on coral sand, Eolis Station 33, and is chosen from a lot of 26 specimens.

Another specimen, Cat. No. 314294, U.S.N.M., comes from 5 miles off the north entrance to Key West Channel in the Gulf of Mexico, 7 fathoms, sand bottom, being Eolis Station 30.

The hexagonal section is confined only to the tip, as the angles quickly assume the character of primary ribs, as in *D. laqueatum*, thus differing from *D. texasianum* and *D. gouldii*, nor are the intercostal spaces as broad or as flat as in those last two species. The exceedingly slender curved tips are like delicate spun glass, transparent and fragile; the intercostal spaces remain very thin and break at the aperture rim, leaving the peristome with the ribs projecting as in young *D. laqueatum*.

Superficially the little shells look exceedingly like the tips of *D. laqueatum*, but they are at once distinguishable by their more slender shape and again by the total absence of a reticulated surface.

DENTALIUM (DENTALIUM) OBSCURUM Dall.

Plate 3, figs. 1, 3.

1889. *Dentalium gouldii obscurum* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 424, pl. 27, fig. 41.

1897. *Dentalium gouldii obscurum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 20, pl. 7, fig. 4.

The shell is awl-shaped, or in general, straight with a moderate curve only in the tip, and is regularly though slowly increasing in diameter. It is vitreous, solid, thin but strong, and with an oily white surface. The tip is polygonal, with nine primary ribs, narrow and sharp, separating flat wide spaces. At the beginning of the second third from the apex the ribs increase by intercalation to twice the original number or even more. All the ribs, both primary and secondary, assume about equal importance and take on a roughened wavy aspect, as though irregularly noduled, an effect seemingly, though not really, caused by growth lines; these growth lines may be seen as merely microscopically fine transverse scratches. The surface character continues to the oral end of the adult shell, there being no degeneration of the ribs into a smooth cylinder. No apical notch or slit is indicated.

The type and four specimens, Cat. No. 95351, U.S.N.M., were dredged by the *Blake*, U. S. C. S. Station 229 off Barbados, in 140 fathoms, on a bottom of coral and broken shell, and temperature of 56.5° F.

One specimen, Cat. No. 95372, U.S.N.M., also taken by the *Blake* at U. S. C. S. Station No. 300, off Barbados, in 82 fathoms, bottom temperature 60°.

Seven specimens, Cat. No. 95330 (*a*), U.S.N.M., were taken by the *Hassler*, U. S. C. S. Station 220, off Sandy Bay, Barbados, in 100 fathoms. Specimens were also taken by the State University of Iowa Expedition of 1918 in 125 fathoms, off Bridgetown, Barbados, being State University of Iowa Station 62.

The greater number of ribs removes this species from the *D. texasianum* group; the curiously roughened appearance suggests a fancy that the shell had suffered a slight melting or softening of its surface. The features appear to be very constant; a narrow variation decreasing the slight curve in the tip to an almost straight shell is observed in a few specimens.

It is evidently a moderate depth species of the lesser Antilles, though as yet only recorded from Barbados.

DENTALIUM (DENTALIUM) CARDUUS Dall.

Plate 3, figs. 4, 5, 7.

1889. *Dentalium carduus* Dall, Bull. Mus. Comp. Zool., vol. 18, pt. 2, p. 423, pl. 27, fig. 3.
1889. *Dentalium carduus* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 3.
1897. *Dentalium (Dentalium) carduus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 30, pl. 7, fig. 6.
1903. *Dentalium carduus* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 3.

The shell is very long and slightly curved, mostly in the posterior third, increasing evenly in diameter; solid, but not thick; slightly compressed dorso-ventrally. It is pure white, with an ashy hue, and sometimes exhibits rusty patches, possibly due to extraneous matter, and is not polished or bright. The sculpture consists of 16 narrow longitudinal ribs, which, just below the tip, are separated by wide, flat spaces. These primary ribs are increased by intercalation, all being of equal importance and continuous; though growing flatter and wider, they do not disappear at the aperture, even in fully adult shells. The entire surface is covered by elevated, transverse riblets of which there are 16 to 20 to the millimeter, appearing like circular lamellae, and which, in crossing the longitudinal ribs, produce a rasp-like surface. This feature is best observed in the posterior half of the shell, but persists in modified degree even to the aperture. There is a dorsally placed, rather deep apical notch.

Length, 87 mm.; diameter, 7 mm. (Dall).

Length, 77 mm.; diameter, 7 mm.; arc, 3.75 (Grenada).

The type is in the Museum of Comparative Zoology, Cambridge, Massachusetts, and was dredged off Santa Lucia, in 116 fathoms. In the United States National Museum are three lots: One specimen, Cat. No. 95322, U.S.N.M., dredged at United States Bureau of Fisheries Station 2655 on Little Bahama Bank, in 338 fathoms, sand bottom, and temperature of 47.5°; one specimen, Cat. No. 95321, U.S.N.M., taken by the *Blake* at United States Coast Survey Station

246, off Grenada, in 154 fathoms, ooze, bottom temperature 56°. It was also dredged in Barbados by the State University of Iowa Expedition in about 100 fathoms.

The transverse sculpture imparting a rough file-like surface to the shell is a feature at once separating this large species from any other of the region under consideration. It appears to belong to the continental slope zone, and is at present only known from the Lesser Antilles and the Bahamas in temperatures ranging from 47.5° to 58° F.

Subgenus ANTALIS H. and A. Adams, 1854.

1854. *Antalis* H. and A. Adams, Gen. Rec. Moll., vol. 1, p. 457 (1854).[1] Type, *D. entalis* Linnaeus.

Tip prismatic or round, with primary riblets ranging from 6 to 18, which are less strongly developed and prominent than in *Dentalium* s. s. and generally disappear entirely in the senescent stages of the shell if not earlier. The apical characters consist of a notch on the convex side or may be lacking. Transverse sculpture is variable or absent.

As already noted the differences between this and the preceding subgenus are not very sharply drawn. It seems to have been made the receptacle for various forms of *Dentalia* that do not readily fit elsewhere, hence the group is a somewhat heterogeneous one. The American species referred here are all less strongly ribbed than are those included under *Dentalium* s. s. The American species conveniently group as follows:

SYNOPSIS OF THE GROUPS OF ANTALIS.

Primary ribs 16–18, more or less distinct; senile stage sculptureless. Northern distribution.................................group of *Dentalium occidentale*, page 34.

Primary ribs 16–18, well defined; senile stage sculptureless, glazed. Southern distribution...group of *D. bartletti*, page 54.

Primary ribs 9–14, fine; color pattern absent; senile stage polished; intercostal sculpture present...................................group of *D. ceratum*, page 49.

Primary ribs 9, coarse; color pattern present; senile stage not polished; intercostal sculpture present................................group of *D. antillarum*, page 43.

Primary ribs 6, their distribution unsymmetric........group of *D. disparile*, page 47.

KEY TO THE GROUP OF DENTALIUM OCCIDENTALE.

Distinctly sculptured.

Long and slender (over 40 mm.)...............*Dentalium agile subagile*, page 38.

Not long and slender (under 40 mm.).

Sculptural features confined to outer superficial shell layer. *D. occidentale*, page 40.

Sculptural features not confined to outer superficial shell layer. *D. occidentale georgiensis*, page 43.

Not distinctly sculptured.............................*D. entalis stimpsoni*, page 35.

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[1] For discussion of the extensive synonymy of *Antalis* see Pilsbry and Sharp, in Tryon's Manual of Conchology, vol. 17, pp. 37 and 38.

DENTALIUM (ANTALIS) ENTALE STIMPSONI, new name.

Plate 4, figs. 2, 3, 4.

1843. *Dentalium entalis*, MIGHELS, Boston Journ. Nat. Hist., vol. 4, No. 3, p. 330. (Not Linnaeus.)

1851. *Dentalium striolatum* STIMPSON, Proc. Bost. Soc. Nat. Hist., vol. 4, p. 114. (Not *D. striolatum* of Jeffreys, Watson, or Sars, nor of Risso, 1826.)

1851. *Dentalium striolatum* STIMPSON, Shells of New England, p. 28.

1853. *Dentalium, striolatum* STIMPSON, Marine Invert. of Grand Menan, Smithsonian Contrib. to Knowledge, p. 22.

1860. *Entalis striolata* STIMPSON, Smithsonian checklists East Coast, p. 4.

1870. *Entalis striolata*, BINNEY, Gould Invt. of Mass., p. 266, fig. 528.

1873. *Dentalium striolatum*, TRYON, American Marine Conchology, p. 96, pl. 12, fig. 96.

1874. *Entalis striolata*, SMITH and HARGER, Trans. Conn. Acad. of Arts and Sci., vol. 3, pt. 1, p. 23, pl. 1, fig. 3.

1880–81. *Dentalium striolatum*, VERRILL, Proc. U. S. Nat. Mus., vol. 3, p. 408.

1883. *Dentalium striolatum*, BUSH, Fish Comm. Report for 1883, No. 17, p. 717.

1884. *Dentalium striolatum*, VERRILL, Trans. Conn. Acad. of Arts and Sci., vol. 6, pt. 1, pp. 276, 283.

1884. *Dentalium striolatum*, VERRILL, Fish. Comm. Report for 1883, No. 16, p. 573.

1887. *Entalis striolata*, GANONG, Bull. Nat. Hist Soc. of New Brunswick, vol. 6, p. 39.

1893. *Dentalium striolatum* BUSH, Bull. Mus. Comp. Zool., vol. 23, No. 6, pp. 224, 239.

1897. *Dentalium* (*Antalis*) *entalis*, PILSBRY and SHARP, Tryon's Man. of Conch., vol. 17, p. 42, in part (not pl. 8, fig. 25).

1901. *Dentalium entalis*, WHITEAVES, Cat. Marine Inv. of E. Canada, p. 152 (Ottawa).

1904. *Dentalium entalis* BLANEY, Proc. Boston Soc. Nat. Hist., vol. 32, No. 2, p. 30.

1908. *Dentalium entalis*, LERMOND, Shells of Maine, p. 15 (Thomaston, Maine).

1915. *Dentalium entalis* JOHNSON, Occasional Papers, Boston Soc. Nat. Hist., No. 13, p. 82.

The shell is very moderately curved, and that chiefly in the posterior fourth; with a rather rapid increase in diameter during the first third; its section is round. The surface is of a dull ivory white, usually more or less discolored. The outer shelly layer covers a softer chalky middle layer, while the inner layer of the tube is hard and smooth. The tips are almost invariably much eroded. Sculpture, save for some longitudinal wrinkles in the posterior quarter or third portion of the shell, is absent. These wrinkles are confined to the outer shell layer and are not always readily observed. The surface of the shell is not perfectly smooth because of irregularities of growth, but the most smooth specimens never exhibit a polished or shining surface. An apical notch is present on the convex side.

Length, 33 mm.; diameter, 4.75 mm.; arc 2 (tip gone). Grand Manan.

Length, 38 mm.; diameter, 4.75 mm.; arc. 2 (tip gone). Grand Manan.

Length, 53.5 mm.; diameter, 5.75 mm.; arc 2.2 (tip gone). Maine, 29 fathoms.

Length, 21 mm.; diameter, 3.5 mm.; arc 2.5 (entire). Gotts Island, Maine.

Length, 44 mm.; diameter, 5.5 mm.; arc 2.5 (tip gone). Kimball Island, Maine.

Length, 36.5 mm.; diameter, 6 mm.; arc 1.5 (tip gone). Gulf of Maine, 36 fathoms.

The type, Cat. No. 314938, U.S.N.M., was collected by the *Eolis* in 20 fathoms, near Gotts Island, off Mount Desert, Maine, from a lot of nine specimens. It measures—length, 38 mm.; diameter 4.8 mm.; with an arc of 2.5.

The museum collection contains a very large series of specimens from the Bay of Fundy and the coast of Maine in shallow water; and from off southern New England and the Virginia Capes on the continental slope. This is a northern cold-water species and is the common shallow water *Dentalium* of New England north of Cape Cod.

There seems to be no question about the specific identity of the western Atlantic shells with the *D. entale* of Linnaeus from European waters. However, the American specimens are generally of a more chalky texture, with a more brittle, thin external layer, and display their faint sculptural features more clearly than do the European specimens. A trayful of eastern Atlantic examples presents a cleaner, whiter, less eroded appearance, owing to the harder, most compact texture of the outer shell layer. There is sufficient constancy in these characters to warrant a subspecific value. Stimpson's name being preoccupied, I have substituted the one here presented.

The lack of definite sculpture distinguishes this from *D. occidentale*, the only other *Dentalium* of the region from moderate depths. The following are the museum collection records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
42	50342	Between St. Peters and Bauguercau (off Nova Scotia) U. S. B. F. Station 2488.	150 fms., 53°, yl. s.
1	74906	Off Nova Scotia, U. S. B. F. Station 128	36 fms., 43.5 m. fne. s.
1	74902	Bedford Basin, Halifax, U. S. B. F. Station 63–67.	26–41 fms., 34°, m.
2	74877	Seal Cove, Grand Menan	8–10 fms.
3	314314	Cape Sable, Nova Scotia (W. F. Clapp, collector).	100 fms., G. (O. Bryant).
4	74875	Grand Menan, U. S. B. F	
120	159702	Grand Menan, U. S. B. F	(Webster.)
27	83437	Grand Menan	(Stimpson.)
1	74879	Bay of Fundy, U. S. B. F. 97	106 fms., 38°.
31	83449	Eastport, Maine	(Verrill and Smith.)
3	59709	Eastport	
3	73286	Eastport	(Stimpson.)
27	74886	Eastport, Maine, U. S. B. F	
7	314315	Eastport, Maine (J. B. H. collector)	
18	314316	Eastport, Maine, (W. F. Clapp, collector)	(N. W. Winkley.)
16	314317	Eastport, Maine	(J. B. Henderson.)
24	10318	Eastport, Maine	(Stimpson.)
30	314318	Little River Light, Maine	40 fms. (J. B. Henderson).

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
18	314319	Frenchmans Bay, Maine	(J. B. Henderson.)
13	184964	Frenchmans Bay, Maine	(D. Blaney.)
17	314320	Long Island, Maine	29 fms. (J. B. Henderson).
8	314321	Gotts Island, Maine	20 fms. (J. B. Henderson), topo types.
8	314322	Off Bakers Island, Maine	20 fms.
2	314323	Isle au Haut, Maine (W. F. Clapp, collector)	
6	314324	Kimballs Island, Maine (W. F. Clapp, collector)	(F. S. Smith.)
2	74892	Casco Bay, Maine, U. S. B. F, 104 B1	12.5 fms., 46.5°, m.
2	203059	Jewells Island, Casco Bay, Maine, U. S. B. F.	
34	83441	Casco Bay, Maine	(Fuller.)
7	159704	Gulf of Maine, U. S. B. F. Station 21B	52–90 fms., 43°, rky.
12	74894	Gulf of Maine, U. S. B. F. Station 52B	27 fms., 42°, r. g.
9	74899	Gulf of Maine, U. S. B. F. Station 39	75 fms., 39°, s. m.
9	74888	Gulf of Maine, U. S. B. F. Station	
1	159705	Gulf of Maine, U. S. B. F. Station 13B	105.5 fms., 40°, br. m.
5	74891	Gulf of Maine, U. S. B. F. Station 33B	22 fms., 48.5°, hrd. rky.
4	159703	Gulf of Maine, U. S. B. F. Station 189	85 fms., 40°, g. p.
8	24628	Coast of Maine	(Stimpson.)
10	74895	Gulf of Maine, U. S. B. F. 55–6B	30–40 fms. 46°, g.
8	74896	Gulf of Maine, U. S. B. F. 66–7B	65–86 fms., 40°, br. m. g.
3	74893	Gulf of Maine, U. S. B. F. 46B	51 fms., 42°, hrd. s. m.
1	74890	Gulf of Maine, U. S. B. F. Station 29B	33 fms., 49°, g. st.
4	74907	Gulf of Maine, U. S. B. F. Station 140	38 fms., 40°, m.
5	74897	Gulf of Maine, U. S. B. F. Station 78B	35 fms., 43°, bu. c. m. s.
3	74900	Gulf of Maine, U. S. B. F. Station 47	59 fms., p. s.
1	74908	Massachusetts Bay, U. S. B. F Station 221	37–38 fms., 49.7°, fne. s. m.
4	83436	Massachusetts Bay	
2	50348	East of Georges Bank, U. S. B. F. Station 2524	85 fms., 42.6°, s. g. st.
1	314938	Gotts Island, Maine	10 fms., type, (J. B. Henderson).
10	34736	Georges Bank, U. S. B. F. Station 2065	80 fms., 44.5°, s. g. brk. sh.
1	50352	Southeast Georges Bank, U. S. B. F. Station 2530.	956 fms., 38.4°, gy. oz.
6	74881	Georges Bank, U. S. B. F. Station 82B	50 fms., 45°, s. sh.
4	74882	Georges Bank, U. S. B. F. Station 83B	60 fms., 58°, s. sh.
6	35090	Georges Bank, U. S. B. F. Station 2055	99.5 fms., bu. m. s. crs. g.
2	34958	Georges Bank	Do.
3	38147	Georges Bank, U. S. B. F. Station 2077	1255 fms., 39°, bu. m.
9	74878	Georges Bank, U. S. B. F. Station 96B	150 fms., 52°, sft. s. m.
7	38121	Georges Bank, U. S. B. F. Station 2072	858 fms., 39°, gy. m.
1	34971	Georges Bank, U. S. B. F. Station 2066	65 fms., 43.5° s. st. g.
45	50349	East of Georges Bank, U. S. B. F. Station 2525	72 fms., 43.6°, s. g. brk. sh.
4	213088	Georges Bank	110 fms. (Packard).
13	74884	La Havre Bank, U. S. B. F. Station 86B	45 fms., 36°, g. st.
4	74885	La Havre Bank, U. S. B. F. Station 87B	60 fms., g. st. spg.
20	50347	La Havre Bank, U. S. B. F. Station 2521	65 fms., 42.1°, sh. g.
2	74916	Cape Cod, U. S. B. F. Station 378	96 fms., 58°, br. m.
5	74911	Cape Cod, U. S. B. F. Station 305	118 fms., 41°, sft. br. m.
10	74909	Cape Cod, U. S. B. F. Station 266	120 fms., bu. m.
2	74913	Cape Cod, U. S. B. F. Station 344	130 fms., 41.8°, br. m.
2	74910	Cape Cod, U. S. B. F. Station 304	122 fms., 41°, sft. br. m.
3	74914	Cape Cod, U. S. B. F. Station 362	106 fms., gy. m.
4	40209	Nantucket Shoals, U. S. B. F. Station 2259	41 fms., 50.2°, gy. s. bk. sp.
46	38150	Off Nantucket Shoals, U. S. B. F. Station 2048	547 fms., 29°, crs. s. m. g.
3	38144	Off Nantucket Shoals, U. S. B. F. Station 2046	407 fms., 40°, bu. m.
1	74898	Off Block Island, U. S. B. F. Station 115–118	20–25 fms., 45°–47°, s. sh.
2	38602	Off Marthas Vineyard, U. S. B. F. Station 941	79 fms., 52°, hrd. s. m.
15	38602	Off Marthas Vineyard, U. S. B. F. Station 1095	321 fms., 40°, sft. gn. m.
1	38607	Off Marthas Vineyard, U. S. B. F. Station 951	225 fms., 41°, m.
13	38595	Off Marthas Vineyard, U. S. B. F. Station 894	365 fms., 40°, sft. br. m. sml. st
10	38621	Off Marthas Vineyard, U. S. B. F. Station 1096	317 fms., 40°, sft. gn. m.
4	73056	Off Marthas Vineyard, U. S. B. F. Station 2213	384 fms., 39.5° gn. m.
40	38594	Off Marthas Vineyard, U. S. B. F. Station 892	487 fms., sft. br. m. sml. st.
1	38596	Off Marthas Vineyard, U. S. B. F. Station 895	238 fms., 42°, sft. m.
1	38613	Off Marthas Vineyard, U. S. B. F. Station 1030	337 fms., 41°, yl. m,
13	38606	Off Marthas Vineyard, U. S. B. F. Station 949	100 fms., 52°, yl. m.
25	38619	Off Marthas Vineyard, U. S. B. F. Station 1073	349 fms., 40°, bu. m. s.
6	38632	Off Marthas Vineyard, U. S. B. F. Station 2183	195 fms., 44.5°, gr. m. s.
2	38622	Off Marthas Vineyard, U. S. B. F. Station 1097	158 fms., 45°, fne. s.
19	38617	Off Marthas Vineyard, U. S. B. F. Station 1038	146 fms., 47°, s. sh.
4	38614	Off Marthas Vineyard, U. S. B. F. Station 1031	255 fms., 46°, yl. m.
19	38627	Off Marthas Vineyard, U. S. B. F. Station 1143	452 fms., 40°, sft. m.
21	38605	Off Marthas Vineyard, U. S. B. F. Station 947	319 fms., 44°, s. m.
1	38598	Off Marthas Vineyard, U. S. B. F. Station 922	71 fms., 52°, gr. m. s.
1	38618	Off Marthas Vineyard, U. S. B. F. Station 1092	202 fms., 41°, gy. s.
1	38624	Off Marthas Vineyard, U. S. B. F. Station 1113	192 fms., 43°, gr. m.
1	38600	Off Marthas Vineyard, U. S. B. F. Station 938	317 fms., 42°, gr. m. s.
51	38593	Off Marthas Vineyard, U. S. B. F. Station 891	480 fms,. sft. br. m.
3	38633	Off Marthas Vineyard, U. S. B. F. Station 2212	428 fms., 40°, gr. m.
2	38616	Off Marthas Vineyard, U. S. B. F. Station 1033	183 fms., s. g.
26	38626	Off Marthas Vineyard, U. S. B. F. Station 1142	322 fms., 41°, m. s. p.
1	38599	Off Marthas Vineyard, U. S. B. F. Station 925	229 fms., 42°, s. m.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	38604	Off Marthas Vineyard, U. S. B. F. Station 945	207 fms., 44°, gr. m. s.
5	103445	Off Marthas Vineyard, U. S. B. F. Station 2583	131 fms., 47.5°, gr. m. s.
8	38609	Off Marthas Vineyard, U. S. B. F. Station 997	335 fms., 40°, yl. m.
24	38625	Off Marthas Vineyard, U. S. B. F. Station 1140	374 fms., 40°, fne. s. sft. m. p.
8	38629	Off Marthas Vineyard, U. S. B. F. Station 1154	193 fms., s. m.
7	73057	Off Marthas Vineyard, U. S. B. F. Station 2214	475 fms., 39.5°, gr. m.
3	38591	Off Marthas Vineyard, U. S. B. F. Station 871	115 fms., 49°, m. fne. s.
5	38612	Off Marthas Vineyard, U. S. B. F. Station 1028	410 fms., 41°, yl. m.
1	38623	Off Marthas Vineyard, U. S. B. F. Station 1098	156 fms., 43.5°, fne. s.
1	38628	Off Marthas Vineyard, U. S. B. F. Station 1144	386 fms., 41°, sft. m.
2	38601	Off Marthas Vineyard, U. S. B. F. Station 939	264 fms., 47°, gr. m. s.
13	38615	Off Marthas Vineyard, U. S. B. F. Station 103[illegible]	208 fms., 46°, yl. m.
4	38630	Off Maryland, U. S. B. F. Station 2172	568 fms., 39°, gr. m.
2	38597	Off Chesapeake Bay, U. S. B. F. Station 898	300 fms., 44°, m.
5	35425	Off Cape Hatteras, U. S. B. F. Station 2109	142 fms., 50.5°, bu. m.
5	159698	Gulf of Maine, U. S. B. F. Station 4B	60 fms., 45°, br. m. s.
2	74927	Gulf of Maine, U. S. B. F. Station 54B	110 fms., 42°, m.
1	74930	Massachusetts Bay, U. S. B. F. Station 230	21 fms., 57°, r. fne. m. s.
1	74919	Georges Banks, U. S. B. F.	150 fms., 52°.
1	43829	Off Marthas Vineyard, U. S. B. F. Station 22[illegible]	50 fms., 51.4°, gn. m.

DENTALIUM (ANTALIS) AGILE SUBAGILE, new subspecies.

Plate 4, fig. 8.

1879. *Dentalium entalis orthrum* WATSON, Journ. Linn. Soc. Zool., vol. 14, p. 512, in part.

1886. *Dentalium entalis orthrum* WATSON, *Challenger* Report Scaphopoda, p. 6, in part.

1897. *Dentalium entalis orthrum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 44, in part.

1897. *Dentalium* (*Antalis*) *agile*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 46, in part (not pl. 8, fig. 36); (not *D. agile*, Dall, Bull. Mus. Comp. Zool., vol. 9, p. 37, 1881); (not *D. agile*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 418, 1889).

1901. *Dentalium agile*, WHITEAVES, Cat. Marine Inv. of E. Canada, p. 152.

1908. *Dentalium agile*, LERMOND, Shells of Maine, p. 15.

1915. *Dentalium agile*, JOHNSON, Occ. Papers, Boston Soc. Nat. Hist., No. 7, p. 83.

The shell is very long and slender; slowly and regularly increasing in diameter from tip to oral end; it is of moderate degree of curvature, pronounced in the tip. The degree of curvature is, however, a variable feature in this species, some specimens being nearly straight. It is of a dull ashy-white color and possesses a thin outer layer of varying degrees of hardness, covering a middle chalky-white layer, which in turn surrounds an inner hard but thin nacreous layer. The outer surface usually flakes off in spots and exposes the chalky texture underneath to the destructive action of the sea water. The sculpture consists of about 18 longitudinal, narrow riblets, separated by wider, rather smooth, shallow spaces between them. The riblets are not increased by intercalation, and continue, though gradually fading, to the aperture except in very old specimens. Between some of the primary ribs there may be occasionally detected some very fine longitudinal lines, which are, however, of minor importance, as they rarely persist. Coarse, irregular growth lines are more or less apparent over the entire shell. All sculptural features are confined to the outer shell layer and are more or less obliterated in most specimens.

The type, Cat. No. 50191 (*a*), U.S.N.M., was dredged at the U. S. B. F. Station 2513 between Halifax and Le Havre Bank, in 134 fathoms, bottom of gray ooze; temperature, 43.6° F. It measures—length, 62 mm.; diameter, 4.75 mm.; arc, 3.5.

Eight lots in the museum collection are all from off Nova Scotia in from 57 to 134 fathoms, with bottom temperatures ranging from 36° to 44° F. One of these measures—length, 88 mm.; diameter, mm.; arc, 5.

The tendency to abnormality in curvature and to other accidents of shape is very remarkable, so much so that a really normal shell is hard to select. Variance in the degree of curvature is unusual in the *Dentalia*—a fact which emphasizes this exception.

The absolute identity of this subspecies with Sars's typical *Dentalium agile* and Jeffreys's *D. abyssorum* of European waters will likely remain a question of individual opinion. The differences between these west and east Atlantic shells are much the same as those noted under *D. entale stimpsoni* (p. 35). When viewed in quantity there is no doubt of a difference. Selected specimens will reestablish an identity. In general the American shells, despite a softer and more chalky texture, possess a sharper sculpture, and the notable tendency to abnormality in shape and curvature is absent from east Atlantic forms. Doctor Dall's *D. agile oleacinum* of the Pliocene is a smooth sculptureless shell and not synonymous with *D. agile subagile*. Doctor Watson's *D. e. orthrum* is an east Atlantic subspecies, to which he referred specimens taken by the *Challenger* off Prince Edward Islands, in 140 fathoms. I have no doubt but that these shells should be referred to our *D. a. subagile*.

The following are the United States National Museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	50191a	Between Halifax and Le Havre Banks, U. S. B. F. Station 2513	134 fms., 44° gy. oz.
25	50191	Between Halifax and Le Havre Banks, U. S. B. F. Station 2513	134 fms., 44° gy. oz.
3	50188	Between Middle Ground and Halifax, U. S. B. F. Station 2505	93 fms., 42°, dk. br. m.
56	50189	Between Middle Ground and Halifax, U. S. B. F. Station 2506	127 fms., 43°, dk. br. m.
21	50192	Between Halifax and Le Havre Banks, U. S. B. F. Station 2514	126 fms., 43°, bk. m.
1	52302	Between Halifax and Le Havre Banks, U. S. B. F. Station 2512	103 fms., 43°, br. m.
1	50193	Le Havre Bank, U. S. B. F. Station 2515	57 fms., 36°, s. g.
2	314325	75 miles east Cape Sable, Nova Scotia, (F. W. Clapp, collector)	105 fms., m. (O. Bryant).

[1] Type.

DENTALIUM (ANTALIS) OCCIDENTALE Stimpson.

1841. *Dentalium dentale*, Gould, Invert. Mass., p. 155, pl. 1, fig. 5 (not *D. dentalis* Linnaeus).

1851. *Dentalium occidentale* Stimpson, Shells of New England, p. 28 (based upon Gould, no description).

1870. *Dentalium dentale*, Gould (Binney Ed.), Invert. Mass., p. 266.

1874. *Dentalium occidentale*, Smith and Hargar, Trans. Conn. Acad. of Arts and Sci., vol. 3, pt. 1, p. 23.

1880. *Dentalium occidentale*, Verrill, Proc. U. S. Nat. Mus., vol. 3, p. 394.

1880. *Dentalium occidentale*, Verrill, Amer. Journ. Sci., ser. 3, vol. 20, No. 119, p. 392.

1882. *Dentalium occidentale*, Verrill, Trans. Conn. Acad. of Arts and Sci., vol. 5, pl. 42, figs. 16–18.

1884. *Dentalium occidentale*, Verrill, Trans. Conn. Acad. of Arts and Sci., vol. 6, pt. 1, p. 216.

1884. *Dentalium occidentale*, Verrill, Rept. Comm. Fish and Fisheries for 1883, p. 573, pl. 28, figs. 123–125.

1884. *Dentalium occidentale*, Bush, Rept. Comm. Fish and Fisheries for 1883, p. 717.

1893. *Dentalium occidentale*, Bush, Bull. Museum of Comp. Zool., vol. 23, No. 6, p. 224.

1897. *Dentalium* (*Antalis*) *occidentale*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 47, pl. 9, figs. 41–43; pl. 13, figs. 9–11.

1901. *Dentalium occidentale*, Whiteaves, Cat. Marine Invert. of E. Canada, p. 152.

1904. *Dentalium occidentale*, Blaney, Proc. Boston Soc. Nat. Hist., vol. 32, No. 2, p. 30.

1908. *Dentalium occidentale*, Lermond, Shells of Maine, p. 15.

1915. *Dentalium occidentale*, Johnson, Occ. Papers Boston Soc. Nat. Hist., vol. 7, p. 83.

The shell is moderately curved, chiefly in its posterior fourth, and increases regularly in diameter; the section is round. Some specimens show a slight dorsoventral compression in the middle posterior portion. Its color is of a dirty white, showing occasionally an ivory tinge; the surface is dull and lusterless. A thin outer layer, a central softer chalky layer, and an inner hard and compact bluish white layer, form the substance of the shell. The two outer layers are subject to erosion, in consequence of which the majority of living specimens present a patchy, worn appearance. The sculpture consists of 16 primary longitudinal, quite sharply defined, narrow rounded riblets, inclosing coarsely surfaced spaces between, of about equal or somewhat greater width than that of the riblets. These riblets are better developed upon the posterior portion, but in some well-preserved adult specimens they persist, though with decreasing definiteness, to the end. Some intercalation may be present. As these sculptural features are mostly confined to the outer shell layer, erosion often obliterates all but mere traces of them. There is an apical notch on the convex side, but this character is often obscure.

Length, 34 mm.; diameter, 3.75 mm.; arc, 2 (almost complete shell).

Length, 34 mm.; diameter, 4 mm.; arc, 1.75 (part of tip lost).

The type has not been preserved.

This is a cold-water species, closely related to *Dentalium entale*, *D. agile*, *D. abyssorum*, and their subspecies. It ranges from Newfoundland to off Hatteras, generally on the continental slope, well offshore, in depths from 20 to 1,000 fathoms. It is not usually found together or associated with *D. entale stimpsoni*, from which it differs by its sculpture, its more slender form, and by its even increase in diameter. From *D. a. subagile* it differs chiefly in the smaller size and in its regular curvature.

Two subspecies may be recognized.

DENTALIUM (ANTALIS) OCCIDENTALE OCCIDENTALE Stimpson.

Plate 4, figs. 1, 5, 6, 7, 9.

This subspecies includes all the specimens answering the general description just given under *D. occidentale* except the group of thinner, more prominently sculptured forms, which will be considered in the next following heading as a distinct subspecies. This typical subspecies is characterized by the thin outer shell layer, or periostricum, overlying the midlayer of softer chalky nature and the resultant decrease in the definiteness of all its sculptural features. It is the usual common form of the species.

Measurements and depth range and geographic distribution are the same as for *D. occidentale*.

The following lots are in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	83433	Gulf of St. Lawrence	(Whiteaves).
1	50190	Between Halifax and La Havre Bank, U. S. B. F. 2512.	103 fms., 43°, br. m.
1	74904	Off Nova Scotia, U. S. B. F. Station 8506	101 fms., 38°.
3	77311	Gulf of Maine, U. S. B. F. Station 176	175 fms., 38°, m.
3	77310	Gulf of Maine, U. S. B. F. Station 175	144 fms., m.
1	74922	Gulf of Maine, U. S. B. F. Station 12B	60 fms., 42°, br. m.
1	74924	Gulf of Maine, U. S. B. F. Station 143 B1	64 fms., 36°, m.
13	74920	Gulf of Maine, U. S. B. F. Station 37B	117 fms., sft. bu. m.
1	74920	Gulf of Maine, U. S. B. F. Station 37B	117 fms., sft. bu. m.
1	77309	Gulf of Maine, U. S. B. F. Station 174	140 fms., 39°, m.
2	74926	Gulf of Maine, U. S. B. F. Station 51 and 73B	105–102 fms., 41°, m. g.
1	159700	Gulf of Maine, U. S. B. F. Station 13B	105.5 fms., 40°, br. m.
10	74934	Off Cape Cod, U. S. B. F. Station 305	118 fms., 41°, sft. br. m.
3	74931	Off Cape Cod, U. S. B. F. Station 266	120 fms., bu. m.
1	74936	Off Cape Cod, U. S. B. F. Station 362	106 fms., gy. m.
2	50195	Southeast Georges Bank, U. S. B. F. Station 2529	662 fms., 39°, gy. m.
2	52085	Southeast Georges Bank, U. S. B. F. Station 2571	1,356 fms., 38°, gy. glob. oz.
1	50196	Southeast Georges Bank, U. S. B. F. Station 2530	956 fms., 38°, gy. oz.
1	74917	Georges Bank, U. S. B. F. Station 85 B	430 fms., 51°, S. g. st.
1	50195	Georges Bank, U. S. B. F. Station 2529	662 fms., 39°, gy. m.
2	43720	Off Nantucket Shoals, U. S. B. F. Station 2217	924 fms., 38°, gy. m.
7	78224	Southeast Nantucket, U. S. B. F. Station 2710	984 fms., gr. m.
11	40326	Off Nantucket Shoals, U. S. B. F. Station 2262	250 fms., 41 gr. m. s.
5	78219	South of Nantucket, U. S. B. F. Station 2682	1,004 fms., s. gr. m.
4	159701	Off Nantucket Shoals, U. S. B. F. Station 2048	547 fms., crs. s. m. g.
26	78046	South of Nantucket, U. S. B. F. Station 2681	990 fms., gn. m.
8	78224	Southeast of Nantucket, U. S. B. F. Station 2710.	984 fms., gn. m.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	50198	Off Nantucket, U. S. B. F. Station 2533	828 fms., br. oz., 38.7°.
1	43717	South of Block Island, U. S. B. F. Station 2207	1,061 fms., 38°, gn. m.
12	78220	South of Block Island, U. S. B. F. Station 2689	525 fms., gn. m.
2	43714	South of Block Island, U. S. B. F. Station 2202	515 fms., 39°, gn. m.
3	314326	South of Block Island, U. S. B. F. Station 2213	384 fms., 39.5°, gn. m.
11	159699	Noank, Conn., U. S. B. F. Station 442	14 fms., 64°, st. g.
5	38571	Off Marthas Vineyard, U. S. B. F. Station 947	319 fms., 44°, s. m.
6	38564	Off Marthas Vineyard, U. S. B. F. Station 895	238 fms., 42°, sft. m.
5	38584	Off Marthas Vineyard, U. S. B. F. Station 1096	317 fms., 40°, sft. gn. m.
4	43713	Off Marthas Vineyard, U. S. B. F. Station 2183	195 fms., 44°, gn. m. s.
2	38556	Off Marthas Vineyard, U. S. B. F. Station 870	155 fms., m. fne. s.
1	38579	Off Marthas Vineyard, U. S. B. F. Station 1032	208 fms., 46°, yl. m.
3	38566	Off Marthas Vineyard, U. S. B. F. Station 938	317 fms., 42°, gn. m. s.
11	43718	Off Marthas Vineyard, U. S. B. F. Station 2212	428 fms., 40°, gn. m.
17	38575	Off Marthas Vineyard, U. S. B. F. Station 998	302 fms., 40°. gn. m.
5	....	Off Marthas Vineyard, U. S. B. F. Station 998	302 fms., 40°, gn. m.
14	103440	Off Marthas Vineyard, U. S. B. F. Station 2583	131 fms., 47.5°, gn. m. s.
6	38564	Off Marthas Vineyard, U. S. B. F. Station 895	238 fms., 42°, sft. m.
31	53033	Off Marthas Vineyard, U. S. B. F. Station 2586	328 fms., 40.2°, dk, gy. m.
9	38563	Off Marthas Vineyard, U. S. B. F. Station 894	365 fms., 40°, sft. br. m. sml. st.
30	50999	Off Marthas Vineyard, U. S. B. F. Station 2547	390 fms., 40°, gn. m.
1	38557	Off Marthas Vineyard, U. S. B. F. Station 871	115 fms., 49°, m. fne. s.
1	74938	Off Marthas Vineyard, U. S. B. F. Station 985	26 fms., 50°, s.
1	38569	Off Marthas Vineyard, U. S. B. F. Station 943	157 fms., 49°, m. s. sh.
13	53055	Off Marthas Vineyard, U. S. B. F. Station 2582	137 fms., 47.2°, gn. m.
26	43719	Off Marthas Vineyard, U. S. B. F. Station 2213	384 fms., 39.5°, gn. m.
12	38561	Off Marthas Vineyard, U. S. B. F. Station 891	480 fms., sft. br. m.
6	38578	Off Marthas Vineyard, U. S. B. F. Station 1028	410 fms., 41°, yl. m.
1	38567	Off Marthas Vineyard, U. S. B. F. Station 939	264 fms., 47°, gn. m. s.
23	77313	Off Marthas Vineyard, U. S. B. F. Station 997	335 fms., 40°, yl. m.
3	53130	Off Marthas Vineyard, U. S. B. F. Station 2588	479 fms., 39.5°, gn. m.
2	38558	Off Marthas Vineyard, U. S. B. F. Station 876	120 fms., 53°, sft. stk. m.
12	38561	Off Marthas Vineyard, U. S. B. F. Station 891	480 fms., sft. br. m.
1	38589	Off Marthas Vineyard, U. S. B. F. Station 869	192 fms., 50°, fne. s.
66	38562	Off Marthas Vineyard, U. S. B. F. Station 892	487 fms., sft. br. m. sml. st.
66	53109	Off Marthas Vineyard, U. S. B. F. Station 2584	541 fms., 40°, gn. m.
30	38582	Off Marthas Vineyard, U. S. B. F. Station 1093	349 fms., 40°, m. s.
7	38585	Off Marthas Vineyard, U. S. B. F. Station 1142	322 fms., 41°, m. s. p.
2	38560	Off Marthas Vineyard, U. S. B. F. Station 880	252 fms., 43°, m.
3	38555	Off Marthas Vineyard, U. S. B. F. Station 869	192 fms., 50°, fne. s.
2	38588	Off Marthas Vineyard, U. S. B. F. Station 1151	193 fms., s. m.
3	38572	Off Marthas Vineyard, U. S. B. F. Station 949	100 fms., 52°, yl. m.
31	38583	Off Marthas Vineyard, U. S. B. F. Station 1095	321 fms., 40°, sft. gn. m.
22	38586	Off Marthas Vineyard, U. S. B. F. Station 1143	452 fms., 40°, sft. m.
21	38592	Off Marthas Vineyard, U. S. B. F. Station 941	79 fms., 52°, hrd. s. m.
2	38568	Off Marthas Vineyard, U. S. B. F. Station 1143	452 fms., 40°, sft. m.
5	151912	Off Marthas Vineyard, U. S. B. F. Station 2547	390 fms., 40°, gn. m.
1	74937	Off Marthas Vineyard, U. S. B. F. Station 869	192 fms., fne. s.
11	38576	Off Marthas Vineyard, U. S. B. F. Station 999	266 fms., gn. m.
2	38587	Off Marthas Vineyard, U. S. B. F. Station 1144	386 fms., 41°, sft. m.
19	43722	South of Long Island, U. S. B. F. Station 2234	810 fms., 39°, gn. m.
1	40240	South of Long Island, U. S. B. F. Station 2235	707 fms., 38.8°, gn. m.
5	43712	South of Long Island, U. S. B. F. Station 2176	302 fms., 41°, bk. m.
2	76830	Southeast of Delaware Bay U. S. B. F. Station 2742.	865 fms., 37°, gn. m.
27	76831	110 miles southeast of Delaware Bay, U. S. B. F. Station 2739.	811 fms., 38.2°, gn. m.
2	314327	Off Delaware Bay, U. S. B. F. Station 2237	520 fms., gn. m., 39.5°.
31	43710	Off Maryland, U. S. B. F. Station 2171	444 fms., 39.5°, gn. m.
17	43711	Off Maryland, U. S. B. F. Station 2172	568 fms., 39°, gn. m.
1	78906	125 miles east of Chesapeake, U. S. B. F. Station 2723.	1,685 fms., gy. oz. for.
1	38127	Off Virginia, U. S. B. F. Station 2003	641 fms.
6	314328	Off Virginia, U. S. B. F. Station 2731	781 fms., gy. oz.
1	314329	Off Virginia, U. S. B. F. Station 2172	568 fms., gn. m.
20	35624	Off Cape Hattoras, North Carolina, U. S. B. F. Station 2115.	843 fms., 39°, m. fne. s.
2	38124	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2109.	142 fms., 50.5°, bu. m.
19	74932	Cape Cod, U. S. B. F. Station 267	135 fms., 41°, bu. m.
5	74933	Cape Cod, U. S. B. F. Station 304	122 fms., 41°, sft. br. m.
9	38581	Cape Cod, U. S. B. F. Station 1090	110 fms., 38.5°, gy. m.
6	38577	Off Marthas Vineyard, U. S. B. F. Station 1025.	216 fms., 45°, gn. m.

DENTALIUM (ANTALIS) OCCIDENTALE GEORGIENSE, new name.

Plate 5, fig. 5.

1884. *Dentalium occidentalis sulcatum* VERRILL, Trans. Conn. Acad. of Arts and Sci., vol. 6, p. 217 (not of Lamarck, 1818, nor of Sacchi).
1884. *Dentalium occidentalis sulcatum* VERRILL, Report of Com. of Fish and Fisheries for 1883, p. 573.
1897. *Dentalium occidentalis sulcatum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 48.
1915. *Dentalium occidentalis sulcatum*, JOHNSON, Occ. Papers Boston Soc. Nat. Hist., vol. 7, p. 83.

This is a form characterized by a greater definiteness of sculpture upon the shell and which assumes the importance of very well marked riblets, with concave grooves between, and further having its sculptural features extend through to the interior of the shell. This is owing to a lesser thickness of its middle or chalky layer. The shells are of a thinner, harder texture, and therefore resist erosion. It is connected with the typical subspecies by intermediates. Verrill's type is not in the museum collection, but there are five lots from his hands from off Georges Bank, and off Marthas Vineyard. One lot from off Marthas Vineyard in 67 fathoms is the least recorded depth.

The specimen figured on plate 5 is from a lot of two examples, Cat. No. 52742, U.S.N.M., dredged by the *Albatross* at the U. S. B. F. Station 2582, off Marthas Vineyard, in 137 fathoms, green mud, bottom temperature 47.2°. It measures—length, 29 mm.; diameter, 3.5 mm.; arc, 2.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	35093	Georges Banks, U. S. F. C. Station 2077	1,255 fms., 39°, bu. m.
1	83434	Massachusetts Bay	
2	52742	Off Marthas Vineyard, U. S. F. C. Station 2582	137 fms., 47.2°, gn. m.
1	92825	South of Marthas Vineyard, U. S. F. C. Station 2244.	67 fms., 52.9°, gn. m.
2	52311	Off Marthas Vineyard, U. S. F. C. Station 2584	541 fms., 40°, gn. m.
1	78225	South of Nantucket, U. S. F. C Station 2682	1,004 fms., gn. m. s.
1	43972	Off Chesapeake Bay, U. S. F. C. Station 2263	430 fms., gn. m.
5	94292	Off Cape Hatteras, Blake Station 35	300 fms., gn. m. (Rush).

KEY TO GROUP OF DENTALIUM ANTILLARUM.

- Shell with nine primary ribs.
  - Color plan of translucent spots present.
    - Microscopic sculpture present................*Dentalium antillarum*, page 44.
  - Color plan of translucent spots absent.
    - Microscopic sculpture absent....................*D. pseudohexagonum*, page 46.

DENTALIUM (ANTALIS) ANTILLARUM Orbigny.

Plate 5, figs. 1, 2, 3, 4, 6, 7, 8.

1846. *Dentalium antillarum* ORBIGNY, Moll. Cuba, vol. 2, p. 202, pl. 25, figs. 10–13.
1887 (?). *Dentalium antillarum*, SIMPSON, Proc. Dav. Acad. Sci., vol. 5, p. 70.
1897. *Dentalium* (*Antalis*) *antillarum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 57, pl. 14, figs. 22–25 (also probably figs. 16, 17, 18, 20, 21). In part. [Not *D. antillarum*, Dall, Bull. Mus. Comp. Zool., vol. 9, p. 37 (1881) nor Dall, Bull. Mus. Comp. Zool., vol. 18, p. 421 (1889) nor Dall, Bull. 37, U. S. Nat. Mus., p. 76 (1889 and 1903), all of which are *Dentalium bartletti*.]
1901(?). *Dentalium antillarum*, DALL and SIMPSON, U. S. Fish Com. Bulletin for 1900, vol. 1, p. 456. [Not *D. antillarum*, Dall in Nat. Hist. Bull., State Univ. Iowa (1896), vol. 4, No. 1, p. 20.]

The shell is small, moderately curved, with its greatest curvature in the extreme posterior position. The apex is rather blunt as it quickly increases in diameter, but thereafter the shell exhibits an even regular slow increase. The tip is sharp, slender, and strongly curved, but it is very rarely retained. The surface is of an opaque white color and sometimes reflects a greenish tint, and is always encircled more or less distinctly by bands of translucent gray, observable usually as translucent spots on the ribs. This is a very characteristic feature, and is never wholly absent in fresh specimens. The texture of the shell is hard, compact, and porcellanous, but not shining. The sculpture consists of nine primary ribs, which are almost at once increased by intercalation to 12. They may be either well elevated or decidedly flattened, at first separating spaces of double their own width; further intercalation of a secondary rib between each primary soon takes place, thereby doubling the original number and causing the ribs and the intercostal spaces to assume about equal widths. The intercalated ribs attain equal importance with the original ones, and all continue, though with decreasing distinctness in senile specimens, to the anterior aperture. In some specimens, however, but little intercalation takes place, the primaries continuing alone to the maturer stages of the shell, when some lesser secondary ribs usually appear. In such forms the primary ribs seem more prominent, especially if they are not flattened, and thus impart to the shell a somewhat different aspect. A further sculptural feature is a system of exceedingly fine transverse lirae within the intercostal spaces, which vary in degree from mere growth lines in some specimens to clearly defined lirae in others. A wide shallow apical notch on the convex, or more rarely on a curved side, is present.

Average specimens measure:

Length, 22 mm.; diameter, 2.1 mm.; arc, 2 (tip intact).
Length, 27 mm.; diameter, 2.5 mm.; arc, 1.75 (tip gone).

As appears in the description, and as might be expected in a shallow-water species of wide distribution, there is here a considerable range of variation, except only in the degree of curvature and in the general shape of the shell. These variations appear in the amount of prominence of the intercostal transverse sculpture. In the majority of specimens observed the longitudinal ribs are flat on top and are of about the same width as the spaces between them. Another form, which is mostly Cuban, has sharper, narrower ribs and shows but little intercalation. Another, which is also chiefly Cuban, has the number of its ribs increased by a double system of intercalation, and all the ribs so greatly widened and flattened that the spaces between are reduced to mere threads. This is the usual form that is found in Habana and Bahia Honda Harbors, though it is not confined to those two localities. In some forms the nine primary ribs are not clearly observable, owing to their almost immediate increase by intercalated secondaries even upon the slender tips, and as the tips are seldom preserved the shell appears to possess more than nine original ribs. The varying degree of intercalation, therefore, makes the actual number of ribs exceedingly inconstant. The curious maculation of the ribs, however, as already stated, is a constant and most striking feature.

The protean character of this species at first led me to divide it into several subspecies, but my divisions always became hopelessly confused by intermediates, and furthermore refused to conform with any distributional principles. I abandoned all attempts to subdivide the variable assemblage here included under Orbigny's meager description. This is the result of a long, patient study of the abundant material at my disposal.

Extreme forms of this species closely resemble the stouter forms of *Dentalium ceratum*, but may be distinguished by their greater curvature, their greater diameter and thickness in the apical portion, their less smooth and glossy surface in the anterior portion, and by the persistent gray color spots on the ribs. Worn fragments of the middle portion of the shell are often quite indistinguishable from *D. ceratum*.

Topotypes, Cat. No. 250089, U.S.N.M., are in the museum collection from St. Thomas. Lots from the Florida Keys, Tortugas (*Eolis*), northwest coast of Cuba, from Esperanza and Cape San Antonio (Barrera Expedition), Habana, Bahia Honda, Cardinas (Barrera Expedition), Bimini Islands (*Eolis*), Samana Bay, Barbados, are all littoral.

This is the most common shallow-water West Indian *Dentalium*, ranging from Barbados throughout the Lesser Antilles, Santo Domingo, Cuba, Florida, Bahamas, All the deep-water records for this species quoted by authors should be regarded as erroneous and as probably referring to other species confused with *D. antillarum*.

The following are the museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
11	250089	St. Thomas	(M. Petit) topotype.
2	314331	Miami, *Eolis* Station. 70	10 fms.
1	314330	Miami, *Eolis* Station 117	35–38 fms.
7	314332	Fowey Light, *Eolis* Station 88	6 fms.
3	314334	Caesars Creek Bank, *Eolis* Station 40	10 fms.
8	314333	Hawk Channel, *Eolis* Station 66	3–4 fms.
1	194635		
1	314338	Key West (inside reef), *Eolis* Station 75	5 fms.
3	53905	Key West (inside reef)	(Hemphill.)
4	314340	Tortugas, *Eolis* Station 34	14 fms.
12	314339	Tortugas, *Eolis* Station 33	16 fms.
14	314335	5 miles off entrance Key West, *Eolis* Station 30	7 fms.
3	314337	Key West (Gulf), *Eolis* Station 102	9 fms.
4	314336	Smith's Shoal, Key West, *Eolis* Station 335	
8	194634	West coast of Florida, U. S. F. C. Station 7106	12½ fms., 63°.
9	194902	do	10–12 fms. (Benedict).
2	95323	Bahamas	(Rawson.)
4	314341	South Bimini Island, *Eolis* Station 74	Shore drift.
2	251378	Bahamas, Mrs. Porter	
3	314344	Cayo Levisa, Cuba, *Eolis* Station 201	
1	314350	Cochinos Bay, Cuba, *Eolis* Station 17	
5	314338	Cabanas Harbor, Cuba, *Eolis* Station 202	
9	95324	Camana Bay, Santo Domingo	16 fms. (Couthouy).
5	314842	Antigua, Falmouth Harbor	
2	19731	Barbados, S. U. I. 410	
2	314843	Antigua, English Harbor, S. U. I. 401	
23	314342	Cape Cajon, Cuba, *Barrera* Station 211	
9	314343	Esperanza, Cuba, *Barrera* Station 210	2–3 fms.
6	314345	Cayo Arenas, Cuba, *Barrera* Station 206	
5	314347	Cabanos Harbor, Cuba, *Barrera* Station 208	1–12 fms.
120	314356	Cardenas Bay, Cuba, *Barrera* Station 212	1–3 fms.
1	314349	do	Do.
7	314374	Hawk Channel, Florida, *Eolis* Station 66	3–4 fms.
2	314380	East of Cape Sable, Florida, *Eolis* Station 4	1½ fms.
2	314361	Esperanza, Cuba, *Barrera* Station 210	2–3 fms.
13	314352	Cape Cajon, Cuba, *Barrera* Station 211	
8	314360	Bahia Honda, Cuba, *Barrera* Station 208	1–12 fms.
4	314355	Punta Tolete, Cuba, *Barrera* Station 205	2–3 fms.
4	314353	Cabanas Harbor, Cuba, *Barrera* Station 203	3–12 fms
1	314354	Punta Colorado, Cuba, *Barrera* Station 207	2–3 fms.
5	314358	Santa Lucia, Cuba, *Barrera* Station 200	2–4 fms.
6	314359	Cayo Levisa, Cuba, *Barrera* Station 201	
53	314357	Santa Rosa, Cuba, *Barrera* Station 209	3–6 fms.
2	314351	South Cat Cay, Bahamas, *Eolis* Station 47	3 fms.
83	314373	Caesars Creek, Florida, *Eolis* Station 40	10 feet.
1	314366	Miami, Florida, *Eolis* Station 83	3 fms.
1	314367	Miami, Florida, *Eolis* Station 113	18–20 fms.
1	314368	Miami, Florida, *Eolis* Station 114	20 fms.
6	314369	Miami, Florida, *Eolis* Station 62	Do.
1	314370	Miami, Florida, *Eolis* Station 93	18–25 fms.
1	314371	Miami, Florida, *Eolis* Station 77	8 fms.
42	314372	1 mile southeast of Fowey Light, *Eolis* Station 8	25 fms.
2	314375	Inside Ajax Reef, *Eolis* Station 55	4 fms.
1	314376	Key West (reef), *Eolis* Station 73	
1	314378	Key West (reef), *Eolis* Station 71	4½ fms.
3	314379	Tortugas, *Eolis* Station 33	16 fms.
1	214340	Charlotte Harbor	(Dall.)
1	314377	Key West (Hawk Channel), *Eolis* Station 65	3–20 feet.
7	314381	Bimini Island, Bahamas, *Eolis* Station 50	20 fms.

DENTALIUM (ANTALIS) PSEUDOHEXAGONUM Ihering.

Plate 6, figs. 1, 2, 3.

Dentalium pseudohexagonum IHERING. (Reference not available.)

This is a species, the shell of which is characterized by nine primary, well-elevated narrow rounded ribs, not at once increased by secondaries on the tip, and which are separated by wider flat spaces between them. The intercostal spaces are crossed by coarse, rather widely spaced growth lines, which in the posterior portion of the shell become more prominent. The intercalation of one rounded secondary rib in each space usually occurs, but the secondary ribs never assume quite the importance of the primaries; all the ribs lose definiteness toward the anterior end of the shell. There are no color features. The shell is more regularly tapering and regularly curved than is *Dentalium antillarum*. None of the museum specimens show an apical notch.

Length, 20 mm.; diameter, 2 mm.; arc 1.5 (juvenile), Brazil.

Length, 23.75 mm.; diameter, 2 mm.; arc 1.5 (no tip), Tampa.

Length, 32 mm.; diameter, 5 mm.; arc 2 (no tip), Sanibel Island, Florida.

This is an example of the Brazil-Gulf of Mexico distribution. It belongs to the littoral zone. Though closely allied to the widely distributed *Dentalium antillarum*, it must not, on the other hand, be confused with the hexagonal *D. disparile*, of similar geographic range, and which it superficially resembles.

I am unable to find Doctor Ihering's description of this species, but have based my diagnosis upon a specimen from Ihering himself, probably a topotype from his original lot. As remarked, the species is closely related to *D. antillarum* in its general appearance, but it lacks the translucent spots and the microscopic transverse intercostal sculpture, in place of which are coarsely raised growth lines. The Florida lots here referred to average a trifle larger than Ihering's specimen, but are certainly conspecific. Both the primary and secondary ribbing of these are coarser and more prominent than in *D. antillarum* and the strong curve in the tip is lacking.

The museum records are set forth in the following table:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	225817	Brazil	(Ihering) author's specimen.
3	53906	Marco, Florida	2 fms. (Hemphill).
3	83783	Charlotte Harbor, Florida	(Dall).
3	61018	Tampa Bay, Florida	5 fms. (Simpson).
4	53904	Cape Romain, Florida (Stearns collection)	(Jewett).
3	53907	Florida	(Hemphill).
3	225015	Port Tampa, Florida, U. S. B. F.	4 fms. Sand.
18	228738	Sanibel Island	(W. F. Clapp).

DENTALIUM (ANTALIS) DISPARILE Orbigny.

Plate 6, figs. 4, 5, 6, 7, 8.

1846. *Dentalium disparile* ORBIGNY, Moll. Cuba, vol. 2, p. 202, pl. 25, figs. 14-17

1878 (?). *Dentalium disparile*, ARANGO, Contrib. Fauna Cubana, p. 232.

1892 (?). *Dentalium disparile*, DALL, Trans. Wagner Free Inst., vol. 3, p. 440.

1897. *Dentalium disparile*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 56, in part, pl. 14, fig. 19 (figs. 16, 17, 18, 20, and 21 are probably *antillarum*). [1881 Not Dall, Bull. Mus. Comp. Zool., vol. 9, p. 37.] [1889 Not Dall, Bull. Mus. Comp. Zool., vol. 18, p. 424.]

The shell is moderately and rather evenly curved, the curvature not being restricted to the apical portion; the tip is hexagonal, long and slender; the diameter of the shell increases regularly; it is thin but strong and of an opaque white, the surface being porcellanous and without translucent spots or bands. The six angles of the apex, with concave spaces between, become six primary narrow rod like ribs, with separating smooth flat spaces. The ribs become so disposed as to leave two broader intercostal spaces on the concave and three narrower spaces on the convex side, one of the ribs being about median on the concave side. Intercalation of secondary longitudinal ribs begins earlier or nearer the apex in the three convex side intercostal spaces than it does in the two concave side spaces, and is again followed later by still further intercalation; whereas in the two concave spaces the increase in the intercalated ribbing is much less, so that at the aperture, except in very senile specimens, the two concave spaces still preserve their definite outline, despite their acquisition of some intercalated ribs. The intercalated or secondary ribs on the convex side assume equal importance with the primaries, but all diminish toward the anterior end, though not losing their identity even in adult shells. There is no transverse sculpture discernible, but rather widely spaced growth lines may be seen with a lens. No apical notch or slit can be detected in any museum specimens.

Length, 14 mm. (Orbigny).

Length, 32 mm.; diameter, 3.4 mm.; arc, 2.1 (most of tip present), Rio de Janeiro.

Length, 33 mm.; diameter, 3.5 mm.; arc, 1.75 (tip gone), Rio de Janeiro.

Length, 26.5 mm.; diameter, 2.9 mm.; arc, 1 (most of tip present, Tampa, Florida.

No topotypes (Martinique) are in the museum collection, but lots from Rio San Sebastian, Brazil, and from Tampa, Florida, are quite typical. One senile specimen from Sabanilla becomes smooth in the anterior third of shell, the ribs quickly degenerating.

Further records from the Philadelphia Academy collection are Porto Barrios and Livingston, Guatemala; Belize Harbor; Roseau and Dominica.

The widely separated geographical records of Brazil and west Florida are not infrequently repeated in other species of mollusks and have already been commented upon under *Dentalium texasianum* and *D. pseudohexagonum.* Were our collection better supplied with shallow-water records from the Caribbean shore of South America and Central America and to Texas, a chain of connections would no doubt be established, particularly in view of the fact that ocean currents favor such distribution. The species also extends northward into the Lesser Antilles as far as Martinique, but seems not to be known from the Greater Antilles, the east coast of Florida, or Hatteras. It is apparently confined to the littoral zone.

Most commentators appear to have fallen into some error in the consideration of this species, generally confusing it with *Dentalium antillarum*. Orbigny's description is short and leaves much to be desired, but his figure, though of a juvenile specimen, is excellent. It is less closely related to *D. antillarum* than it is to *D. texasianum* and to a Pliocene group represented by *D. coloosaense* Dall, *D. prisma* Dall, and *D. octocostellatus* Pilsbry and Sharp. It might with equal propriety be placed under *Dentalium* s. s.

The following are the five records in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	61018a	Tampa Bay, Florida	(Simpson).
1	93833	Sabanilla, West Indies	Shore (Hering).
2	225819	San Sebastian, Brazil	
2	150784	do	
3	18711	Rio Janerio	United States Exploring Expedition.

KEY TO THE GROUP OF DENTALIUM CERATUM.

- Tip 9 angled.
    - Smooth posterior portion produced.
        - No intercalation on tip.................. *Dentalium ceratum ceratum*, page 50.
        - Intercalation on tip (to 12 or 14).
            - Color yellow.
                - Diameter of 2 mm. (Florida)............ *D. ceratum flavum*, page 51.
                - Diameter of less than 2 mm. (Barbados).. *D. ceratum tenax*, page 52.
    - Smooth posterior portion not produced.
        - Color green.................................... *D. taphrium*, page 53.

DENTALIUM (ANTALIS) CERATUM Dall.

1881. *Dentalium ceratum* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 38.

1889. *Dentalium ceratum* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 424, pl. 26, fig. 5; pl. 27, fig. 2.

1889. *Dentalium ceratum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 26, fig. 5.

1897. *Dentalium ceratum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 57, pl. 7, figs. 4, 5.

1903. *Dentalium ceratum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 26, fig. 5.

The shell is awl-shaped, with the chief curvature in the tip or extreme posterior portion, the balance of the shell having a relatively small arc. In color it is of a waxen yellow ranging from a brilliant yellow in some specimens, especially in the posterior half, to a pale yellowish tint becoming white in the anterior half of the shell. The texture of the shell is glassy, with a polished shining surface. The tip is nine ("seven") angled in section. The angles forming nine primary rodlike riblets narrow and sharply defined and separated by wide flat intercostal spaces. These primary riblets may continue for some distance without the intercalation of any secondaries, to be eventually supplemented, however, by a few secondaries, or intercalation may take place very early, even upon the tip, doubling the original nine riblets in number. The secondary riblets assume about equal prominence with the primaries, but at the beginning of the middle third portion of the shell all the sculptural features become fainter, and finally disappear entirely, leaving the second or anterior half of the shell perfectly smooth. An intercostal microscopic reticulation exists, formed by 15 to 20 minute longitudinals crossed by equally minute transverse lines, making a delicate network of exquisite finish. This feature persists only to where the primary riblets dissolve into the smooth polished cylinder. There is no very definite apical notch or slit observable, but a trace of such is indicated in a few tips on the convex side.

Length, 30 mm.; diameter, 2 mm. (type).

Length, 32 mm.; diameter, 2 mm.; arc, 2 (off Habana).

Length, 56 mm., diameter, 2.5 mm.; arc, 1.5 (tip gone) (off Habana). This giant specimen has the anterior three-fourths portion smooth.

Specimens average about 25 mm. in length. After the senile stage is reached, growth thereafter becomes a variable feature. An average shows in a length of 25 mm., one-third portion of shell ribbed and the remaining two-thirds smooth.

The type, Cat. No. 95326, U.S.N.M., was obtained by the *Blake* at U. S. B. F. Station 2 off Habana, in 805 fathoms, bottom temperature 39.75° F.

There is some variation in the number of riblets in this species, but there is no variation in the original number. The yellow color is very characteristic, but is not always preserved in dead shells, and probably wholly fades in time from specimens collected alive and in perfect condition. From the museum records it appears to be a species of the Antillean continental slope, though occupying a shallower zone on the edge of the Gulf Stream off the Florida Keys.

The variants are indicated in the following two subspecies described in more detail.

DENTALIUM (ANTALIS) CERATUM CERATUM Dall.

Plate 7, figs. 2, 4, 5, 6, 7.

The typical subspecies is restricted to those forms in which the nine primary riblets are not at once increased by the intercalation of secondary riblets. Such additions are but few; generally less than nine. In this respect only may *Dentalium ceratum ceratum* be distinguished from the other subspecies enumerated. The type, Cat. No. 95326, U.S.N.M., is the same as given for *D. ceratum*. The geographical range also remains the same.

The following are the museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	314382	Southeast of Sand Key, Florida, *Eolis* Station 6..	35 fms., s. brk. sh.
1	314383	Off Sand Key, Florida, *Eolis* Station 327.........	85 fms.
2	314384	Off Sand Key, Florida, *Eolis* Station 100.........	65 fms.
1	314385	Off Sand Key, Florida, *Eolis* Station 300.........	72 fms.
5	314386	Off Sand Key, Florida, *Eolis* Station 338.........	85 fms.
4	314387	Off Sand Key, Florida, *Eolis* Station 326.........	75 fms.
1	314388	Off Sand Key, Florida, *Eolis* Station 3..........	69 fms., s. brk. sh.
3	314389	Key West, Florida, *Eolis* Station 63.............	78 fms.
2	314390	Off Western Dry Rocks, *Eolis* Station 319........	90 fms.
2	323958	Off San Blas, U. S. B. F. Station 2404............	60 fms., gy. s.
1	62651	Off Mouth Mississippi River, *Blake* Station 47...	321 fms., 46.75°.
[1]4	95326	Off Habana, Cuba, *Blake* Station 2...............	805 fms., 39.75°.
1	95329	Off Habana, Cuba, *Blake* Station 57..............	177 fms.
2	95328	Off Morro Light, Habana, *Blake* Station 101.....	200 fms.
1	95370	Off Morro Light, Habana, *Blake* Station 100.....	400 fms.
1	94107	South of Cuba, U. S. F. C. Station 2135...........	250 fms., hrd. C.
2	95327	Yucatan Bank, *Blake* Station 36..................	84 fms.
2	161571	Mayaguez, Porto Rico, U. S. B. F. Station 6067..	97 fms.
1	108164	Off Fernandina, Florida, U. S. B. F. Station 2668.	294 fms., 46.3°, gy. s., dd. co.
11	314892	Antigua, off English Harbor, S. U. I. Experiment Station 115.	120 fms.
3	314893	Barbados, S. U. I. Expedition Station 48	80 fms.
1	314894	Barbados, S. U. I. Expedition Station 67	50–60 fms.
1	314895	Barbados, S. U. I. Expedition Station 13	80 fms.
1	314896	Barbados, S. U. I. Expedition Station (?)	Deep.
1	314897	Barbados, S. U. I. Expedition Station 10	100 fms.

[1] Type..

DENTALIUM (ANTALIS) CERATUM FLAVUM, new subspecies.

Plate 7, fig. 1.

The shell, like the typical subspecies, is awl-shaped, slightly curved, chief curvature being in the extreme posterior portion; the tip is very short, rapidly increasing in diameter and giving a thickened appearance to the posterior portion of the shell, when it is retained. The color is a bright yellow, becoming less intense in the senescent fourth of the shell, but often persisting even to the aperture. In some specimens reddish splotches are noticeable. There are 12 to 14 riblets beginning upon the early portion of the nine-angled tip; these may be later increased somewhat by further intercalation of less prominent secondary riblets, and all finally become evanescent and disappear at about the middle portion of an adult shell, the anterior half being smooth and highly polished. The intercostal spaces are reticulated by a very delicate microscopic sculpture more apparent in the first quarter of the shell. This reticulation, along with the riblets, finally disappears, as all the sculptural features merge and fuse into a smooth surface. A shallow, broad notch on the convex side is a probable apical feature, though not often noticeable.

The type, Cat. No. 314391, U.S.N.M., measures—length, 26.5 mm.; diameter, 2 mm. It was dredged off Key West, Florida, in 110 fathoms, being *Eolis* Station No. 333.

This is a subspecies chiefly of the Florida Keys region, occurring just within the line of the Gulf Stream. It differs from *Dentalium* *ceratum ceratum* in the greater number of its early riblets, a shorter stouter apex, and a more rapidly increasing diameter. The yellow color seems to be more constant and vivid. It occupies an intermediate position between *D. ceratum ceratum* and *D. taphrium*, though quite distinct from both.

The following are the museum collection records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 9	314391	Off Key West, Florida, *Eolis* Station 333	110 fms.
1	314392	Off Fowey Light, Florida, *Eolis* Station 123	22 fms.
4	314393	Key West, Florida, *Eolis* Station 344	100 fms.
2	314394	Key West, Florida, *Eolis* Station 146	98 fms.
1	323016	Key West, Florida, U. S. B. F. Station 2315	37 fms., co.
3	314395	Off Sand Key, Florida, *Eolis* Station 98	70–90 fms.
13	314396	Off Sand Key, Florida, *Eolis* Station 337	90 fms.
1	314397	Off Sand Key, Florida, *Eolis* Station 338	85 fms.
1	314398	Off Sand Key, Florida, *Eolis* Station 328	90 fms.
2	314399	Off Sand Key, Florida, *Eolis* Station 322	115 fms.
6	314400	Off Sand Key, Florida, *Eolis* Station 325	95 fms.
1	314401	Off Sambo Reef, Florida, *Eolis* Station 332	115 fms.
1	314402	Triumph Reef, Florida, *Eolis* Station 350	70–90 fms.
3	314403	Sambo Reef, Florida, *Eolis* Station 329	135 fms.
5	314404	Sambo Reef, Florida, *Eolis* Station 331	118 fms.
1	314405	Cabanas Harbor, Cuba, *Barrera* Station 202	25 fms.

[1] Type.

DENTALIUM (ANTALIS) CERATUM TENAX, new subspecies.

Plate 7, fig. 3.

The shell differs only from the typical subspecies in that it is less awl-shaped and more regularly curving; it is also rather more slender. The color is less yellow in all the National Museum specimens, but these have likely faded, as the material is old or poor. Almost complete tips show a smooth nuclear portion, with 9 primary riblets quickly increased to 12 or 14. All other sculptural features, including the delicate intercostal network, are as in *D. c. ceratum* and *D. c. flavum*. No apical notch is observable.

The type, Cat. No. 95331 (*a*), U.S.N.M., measures—length, 19 mm.; diameter, 1.75 mm. It is from Barbados, 76 fathoms, taken by the *Blake* at United States Coast Survey Station 272, bottom of coral and broken shell, with a temperature of 64.75° F.

Other lots in the museum collection are from Barbados, in 100 fathoms, Cat. No. 95330, U.S.N.M., taken by the *Hassler* in 1871, Barbados, in 33 fathoms; Cat. No. 314898, U. S. N.M., dredged by the State University of Iowa Expedition Station 51; Barbados, in 70 fathoms, Cat. No. 314899, U.S.N.M., dredged by the State University of Iowa Expedition Station 79.

This is a geographic race of *D. ceratum*, occupying the extreme southern limit of the range of that species. It is of the *D. c. flavum* type of ribbing, but smaller and more slender than that Floridian subspecies.

DENTALIUM (ANTALIS) TAPHRIUM Dall.

Plate 7, fig. 8.

1889. *Dentalium taphrium* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 422.
1889. *Dentalium taphrium* Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1897. *Dentalium taphrium*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 58.
1901 (?). *Dentalium taphrium* Dall and Simpson, U. S. Fish. Comm. Bull. for 1900, vol. 1, p. 455, pl. 54, fig. 19.
1903. *Dentalium taphrium* Dall, Bull. 37, U. S. Nat. Mus., p. 76.

The shell is rather short, awl-shaped, with its maximum curvature at the base of the tip; thereafter it is but slightly curved. It quickly expands in diameter at the start and thence through the middle and anterior portions very gradually. A very constant and characteristic feature is its apple green color. On the sculptured portion of the shell are series of irregular zones of translucency encircling the shell and so disposed as to impart a watered silk appearance. This color feature, however, does not extend to the smooth anterior portion of the cylinder, which is of a clear translucent apple green color and is polished and shining. There are 14 sharp, well-defined riblets, though originally probably nine primaries, which are quickly increased to double or even more by subsequent intercalation; all the riblets become lower and more square in outline, and finally growing fainter disappear into a smooth, highly polished glassy round cylinder. In the intercostal spaces is a network of microscopic transverse and longitudinal lines, which also disappear on the smooth, anterior portion of the shell. The longitudinal miscroscopic lines are usually indistinct. There is a shallow apical notch on the convex side.

Length, 17 mm.; diameter, 2 mm.; arc. 75 (type).

Length, 25 mm.; diameter, 2.25 mm.; arc, 2.1 (tip gone), Florida.

The type, Cat. No. 95320, U.S.N.M., was dredged between Mississippi Delta and Cedar Keys in 30 fathoms, gray sand and broken coral, being U. S. B. F. Station 2405; no bottom temperature given.

There are also lots from off Cape Hatteras and Cape Lookout in 22 to 52 fathoms, and many from the Florida Keys region in 20 to 60 fathoms, the majority of the records coming from 30 to 45 fathoms, just inside the Gulf Stream; also from Cabanas Harbor, Cuba, in 25 fathoms (form).

In the many lots of specimens studied there are none that prolong the final shell stage of smooth, glassy surface to the extent often seen in *Dentalium ceratum*. The proportion of the smooth to the sculptured portion in this species is usually about as one to seven.

The differences between this and its nearest relative, *D. ceratum*, are in the greater number of riblets; the green instead of yellow color, and in the presence of translucent zigazg zones, wholly lacking in *D. ceratum;* the relatively short smooth portion of the shell; the shorter length but equal diameter.

Geographically its range is more northerly and its depth zone less. Its characters are remarkably constant. There is no complete tip preserved among the many lots of the museum collection.

The following are the museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	95320	Between Mississippi Delta and Cedar Keys, U. S. B. F. Station 2405.	30 fms. gy. s. bk. co. (type).
14	93120	31 miles southeast of Lookout, North Carolina, U. S. B. F. Station 2612.	52 fms., sand, crs. w. s. sh.
1	93119	17 miles off Lookout, North Carolina, U. S. B. F. Station 2608.	22 fms., sand, crs. gy. s. brk. sp.
6	92819	25 miles off Cape Hatteras, U. S. B. F. Station 2598.	22 fms., sand, wh. s. brk. sh.
1	329749	Off Cape Hatteras, U. S. B. F. Station 2598	22 fms., wh. s. sh.
8	314406	Miami, Florida, *Eolis* Station 312	75 fms.
5	314407	Miami, Florida, *Eolis* Station 49	30 fms., s. and co.
1	314408	Miami, Florida, *Eolis* Station 139	30 fms.
9	314409	Miami, Florida, *Eolis* Station 62	20 fms.
10	314410	Miami, Florida, *Eolis* Station 118	30 fms.
2	314411	Miami, Florida, *Eolis* Station 117	35-38 fms.
3	314412	Miami, Florida, *Eolis* Station 141	35 fms.
2	314413	Miami, Florida, *Eolis* Station 157	22 fms.
2	314414	Miami, Florida, *Eolis* Station 77	8 fms.
1	314415	Miami, Florida, *Eolis* Station 84	40 fms.
7	314416	Miami, Florida, *Eolis* Station 51	24 fms.
1	314417	Miami, Florida, *Eolis* Station 103	20 fms.
1	314418	Miami, Florida, *Eolis* Station 48	60 fms., g. mn.
4	314419	Miami, Florida, *Eolis* Station 93	18-25 fms.
4	314420	Miami, Florida, *Eolis* Station 122	30 fms.
2	314421	Miami, Florida, *Eolis* Station 114	20 fms.
2	314422	Miami, Florida, *Eolis* Station 51	24 fms.
2	314423	Off Fowey Light, Florida, *Eolis* Station 148	38 fms.
5	314424	Off Fowey Light, Florida, *Eolis* Station 90	44 fms.
1	314425	Off Fowey Light, Florida, *Eolis* Station 187	45 fms., sp.
2	314426	Off Fowey Light, Florida, *Eolis* Station 105	40 fms.
2	314427	Off Fowey Light, Florida, *Eolis* Station 121	30 fms.
1	314428	Off Fowey Light, Florida, *Eolis* Station 76	40 fms.
2	314429	Off Fowey Light, Florida, *Eolis* Station 188	48 fms., sp.
3	314430	Off Fowey Light, Florida, *Eolis* Station 78	30 fms.
6	314431	Off Fowey Light, Florida, *Eolis* Station 8	25 fms.
1	314432	Off Fowey Light, Florida, *Eolis* Station 134	40 fms.
8	314433	Off Fowey Light, Florida, *Eolis* Station 92	45 fms.
5	314434	Off Fowey Light, Florida, *Eolis* Station 121	30 fms.
2	314435	Off Fowey Light, Florida, *Eolis* Station 129	48 fms.
3	314436	Off Fowey Light, Florida, *Eolis* Station 142	40 fms.
2	314437	Off Fowey Light, Florida, *Eolis* Station 144	45 fms.
1	314438	Off Fowey Light, Florida, *Eolis* Station 91	42 fms.
2	314439	Off Fowey Light, Florida, *Eolis* Station 130	25 fms.
3	314440	Off Fowey Light, Florida, *Eolis* Station 107	40-50 fms.
3	314441	Off Fowey Light, Florida, *Eolis* Station 79	35 fms.
3	314442	Off Fowey Light, Florida, *Eolis* Station 150	35 fms.
5	314443	Off Long Reef, Florida, *Eolis* Station 135	38 fms.
8	314444	Off Couch Reef, Florida, *Eolis* Station 7	35 fms.
1	314445	Off Ajax Reef, Florida, *Eolis* Station,137	40 fms.
2	314446	Off Sand Key, Florida, *Eolis* Station 99	30 fms.
6	314447	Off Sand Key, Florida, *Eolis* Station 101	38 fms.
1	314448	Cabanas Harbor, Cuba, *Barrera* Station 202	25 fms.

KEY TO THE GROUP OF DENTALIUM BARTLETTI.

Primary riblets 18.
  Section slightly flattened .... *Dentalium bartletti*, page 55.
Primary riblets 16.
  Section round .... *D. tubulatum*, page 56.

DENTALIUM (ANTALIS) BARTLETTI, new species.

Plate 8, fig. 2, 7.

1881. *Dentalium antillarum*, Dall, Bull. Mus. Comp. Zool., vol. 9, p. 37 (not of Orbigny, 1846).

1889. *Dentalium antillarum*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 421 (not of Orbigny, 1846).

1889. *Dentalium antillarum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76, in part.

1897. *Dentalium antillarum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 57, in part. Not figured on pl. 14.

1903. *Dentalium antillarum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76 (in part).

In the National Museum collection are a number of lots of long, slender, slightly curved *Dentalia*, with very fine longitudinal riblets, all collected from the continental slope zone. For the most part these shells have been referred to Orbigny's *D. antillarum*. They all bear the glazed aspect so characteristic of many deep-water Scaphopods, and they possess, moreover, no trace of any transverse sculpture. They also belong to a deeper, colder water zone than does Orbigny's *D. antillarum*, which is a semilittoral species. The following diagnosis is given from an excellent specimen taken off Frederickstadt:

The shell is very slightly curved, the chief curvature occurring rather abruptly near the posterior end, quite thin; regularly increasing in diameter to 4 mm. in a length of 42 mm. The color is ivory white. The apical sculpture consists of about 18 thread-like riblets, with smooth spaces between of double their own width. The ribs continue to the posterior end in a slightly wavy course, their original primaries being greatly increased in number of intercalation of secondaries. At the oral end of the shell the ribs are 40 to 50 in number, but less distinct and are wider than their intervals. In the anterior half minute growth lines to be seen under a lens interrupt the longitudinal riblets, giving a roughened or wavy appearance to the surface. The entire surface has a glazed ivory white finish. The anal orifice bears a wide, fairly deep apical notch on the convex side. The shell is slightly flattened laterally and the aperture is oblique.

Length, 42 mm.; greater diameter, 3.75 mm.; lesser diameter, 3.5 mm.; arc, 1.7 (type).

Length, 55 mm.; greater diameter, 4 mm.; lesser diameter, 4 mm.; arc, 1.75 (tip gone).

Length, 34 mm.; greater diameter, 2.5 mm.; lesser diameter, 2 mm.; arc, 1.1 (Florida specimen).

Same variation is shown in the rate of increase of diameter. In a specimen from 193 fathoms off Cape Florida the shell is much more slender than the type, though preserving all other characters of the species.

The type, Cat. No. 224986, U.S.N.M., was taken by the *Blake* at the U. S. Coast Survey Station 130, off Frederickstadt, Santa Cruz, in 451 fathoms, gray ooze, bottom temperature 44.5° F.

The following are the museum collection records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	224986	Frederickstadt, *Blake* Station 130	451 fms. (type) gy. oz., 44.5°.
1	93121	Off Cape Fear, U. S. B. F. Station 2616	17 fms., s. p.
1	314449	Off Fowey Light, Florida, *Eolis* Station 353	85 fms.
1	330524	Off Cape Florida, Florida, U. S. B. F. Station 2641	193 fms., gy. s., 43.4°.
1	314450	Off Fowey Light, Florida, *Eolis* Station 372	100 fms.
9	93840	Between Mississippi Delta and Cedar Keys, U. S. F. C. Station 2398.	227 fms., 48.6° gy. m.
1	323776	Off Cape San Blas, Florida, U. S. B. F. 2399	196 fms., gy. m., 51.6°.
3	94368	N. W. of Tortugas, *Blake* Station 44	539 fms., 39.5°.
1	95370	Off Morro Light, Habana, *Blake* Station 100	400 fms.
1	94081	Off Arrowsmith Bank, Yucatan, U. S. B. F. 2355	399 fms., yl. oz.
11	95371	St. Vincent, West Indies, *Blake* Station 230	464 fms., 41.5° fne. s.
1	95369	Martinique, *Blake* Station 211	357 fms., fne. s.

DENTALIUM (ANTALIS) TUBULATUM, new species.

Plate 8, fig. 5.

The shell is of porcellanous texture, almost straight, with a very gradual increase in diameter; it has 16 sharply defined longitudinal riblets, separated by smooth intercostal spaces, double their width; no intercalation takes place before a point about midway between the tip and the aperture; then one delicate wavy riblet faintly appears in each space. These secondaries gradually increase in importance, widening as do the original primary riblets until at the oral end of the shell all are so widened and flattened that the intercostal spaces are almost obliterated. Over the anterior portion of the shell distinct growth lines produce a wavy appearance in the riblets. The cylinder is round and the aperture is not oblique. There is a broad and shallow apical notch on the convex side.

This species is closely related to *Dentalium bartletti*, but differs in its straightness, its slenderness, and round section, the less glazed surface, and finally in its 16 instead of 18 primary riblets.

The type, Cat. No. 95367, U.S.N.M., measures: Length, 37 mm.; diameter, 2.4 mm.; curvature, about 0.90 (tip gone). It is from a lot of two specimens, the other measuring—Length, 37 mm.; diameter, 2.25 mm.; arc, 1°(tip gone); and was dredged off Bahia Honda, Cuba, by the *Blake* at the United States Coast Survey Station 20, in 220 fathoms, bottom temperature 62° F.

Other lots are five specimens (fragments), Cat. No. 108160, U.S.N.M., from U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, gray sand and dead coral, bottom temperature 46.3°.

Subgenus HETEROSCHISMA Simroth, 1895.

1895. *Heteroschisma* Simroth, Bronn's Klassen u. Ordnungen des Thier-Reichs, vol. 3, p. 460.

Shell coarsely striate longitudinally and with an apical slit placed on the concave side.

This is a subgenus of doubtful value, as it can not be made to include all species possessing the peculiarity of an apical slit on the concave side—its one distinguishing feature. Pilsbry and Sharp[1] have restricted the group to two species, one of which is certainly, and the other doubtfully, of western Atlantic distribution.

DENTALIUM (HETEROSCHISMA) CALLITHRIX Dall.

Plate 8, figs. 3, 4, 6.

1889. *Dentalium callithrix* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 427, pl. 27, fig. 10.

1889. *Dentalium callithrix* Dall, Bull. 37, U. S. Nat. Mus., p. 75, pl. 27, fig. 10.

1889. *Dentalium callithrix* Dall, Proc. U. S. Nat. Mus., vol. 12, p. 240.

1897. *Dentalium* (*Heteroschisma*) *callithrix*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 62, pl. 7, fig. 3.

The shell is regularly, moderately to strongly curved, with a gradual increase in diameter; it is slightly laterally compressed, causing the oral aperture to be slightly oval. The color is white, porcellanous, but not polished or shining. The tip is nine-angled, with smooth concave intercostal spaces, which later become flatter. At a certain point the intercostal spaces assume, all at the same time, at least three intercalated secondary riblets, which gradually increase in distinctness as the primaries lose, all finally becoming subequal in the anterior portion of the shell. In some cases the primaries retain a slight predominance over the secondaries, even to the aperture. There is no transverse sculpture beyond some hardly observable growth lines, which, toward the aperture, lend a slightly wavy appearance to the riblets. There is no perfectly smooth surface even in senile specimens. A fairly long slit on the concave side is the apical feature.

Length, 24 mm.; greater diameter, 2.75 mm.; lesser diameter, 2.25 mm.; arc, 1.8 type (juv.).

Length, 52.75 mm.; greater diameter, 3.25 mm.; lesser diameter, 3 mm.; arc, 6.5; senile specimen, St. Kitts.

Length, 28.25 mm.; greater diameter, 3 mm.; lesser diameter, 2.75 mm.; arc, 2 (juv.), Cape Fear.

Length, 38 mm.; greater diameter, 3.1 mm.; lesser diameter, 2.9 mm.; arc, 2 Brazil.

The type, Cat. No. 95348, U.S.N.M., was taken by the *Blake* at a United States Coast Survey Station not recorded in Yucatan Straits, in 640 fathoms.

This is a remarkably constant species of exceptionally wide range. It belongs to the lower zones of the continental shelf and to the ocean floor. The Argentine record consists of but broken fragments, though recognizable. The depth of 11 fathoms, as given at this Argentine station, suggests an error as already commented upon.

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[1] Tryon, Man. Conch., vol. 17, p. 61–62.

The following are the museum collection records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	95348	Yucatan Strait, *Blake* Station (?)	640 fms.
7	93426	Off Cape Fear, North Carolina, U. S. B. F. Station 2678.	731 fms., gy. oz.. 38.7°.
2	93758	Bet. Miss. Delta and Cedar Keys, Station 2383.	1,181 fms., gr. mud, 40°.
1	95349	Off Bahia Honda, Cuba, *Blake* Station 20	220 fms., 62°.
11	87553	South of St. Kitts, U. S. B. F. Station 2751	687 fms., bu. oz., 39.9°.
9	330759	South of St. Kitts, U. S. B. F. Station 2751	Do.
2	95350	Off Bequia, *Blake* Station 236	1,591 fms., lt. br. oz., 39°.
3	87555	East of Tobago, U. S. B. F. Station 2751	880 fms., oz.. 37.9°.
1	314451	Brazil, U. S. B. F. Station 2763	671 fms.. 37.9° br. glob. oz.
15	330834	Off Rio de la Plata, U. S. B. F. Station 2764	11¼ fms., s., brk. sh.

[1] Type.

DENTALIUM (HETEROSCHISMA) SUBTERFISSUM Jeffreys.

Doctor Watson has referred to this European species of Jeffreys some specimens taken by the *Challenger* at Station 120 off Pernambuco in 675 fathoms.[1] I am inclined to believe that these specimens are probably referable to Doctor Dall's *callithrix* rather than to the northeast Atlantic species of Jeffreys. In the present state of doubt I include it in this list only as a possible member of the faunal area under discussion.

Subgenus FISSIDENTALIUM Fischer, 1895.

1895. *Fissidentalium* Fischer, Manuel de Conchyliologie, p. 894.

"A long fissure on the convex side in the posterior portion of the shell; surface longitudinally striate." Pilsbry and Sharp [2] have expanded this very meager description to include a series of very large solid shells with very many longitudinal riblets and with or without a long slit at the apex. The value of the subgenus is very doubtful. The western Atlantic species included in this paper are *Dentalium meridionale* with its several subspecies, *D. floridense*, and *D. amphialum*—all *Dentalia* with large shells and belonging to rather deep water zones. The following key is not very satisfactory, but may aid in separating the forms:

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[1] *Challenger* Report, Gastropoda and Scaphopoda, p. 10.

[2] Tryon, Man. Conch., vol. 17, p. 63.

KEY TO THE SPECIES OF THE SUBGENUS FISSIDENTALIUM.

Tip hexagonal; size medium (74 mm. by 10 mm.).
  Maximum of 24 riblets, color yellowish.....................*floridense*, page 64.
Tip 16 ribbed.
  Maximum of 90 riblets; ashen or mouse color.
    Riblets persisting to aperture.
      Very large (length 108 mm. by diameter 14 mm.).....*meridionale*, page 59.
      Stouter forms (diameter 14 mm.) .... *m. meridionale*, page 61.
      Slenderer forms (diameter 10 mm.) .... *m. jamaicense*, page 62.
    Riblets not persisting to aperture.
      Medium sized (length 96 mm. by diameter 10 mm.).....*m. verrilli*, page 62.
  Maximum of 50 riblets; yellowish brown.
      Smaller size (length 50 mm. by diameter 7.5 mm.).....*amphialum*, page 59.

DENTALIUM (FISSIDENTALIUM) AMPHIALUM Watson.

Plate 8, fig. 1.

1879. *Dentalium amphialum* WATSON, Journ. Linn. Soc. London, vol. 14, p. 510.

1885. *Dentalium amphialum* WATSON, *Challenger* Report, Scaphopoda, etc., p. 3, pl. 1, fig. 3.

1897. *Dentalium* (*Fissidentalium*) *amphialum*, PILSBRY and SHARP, Man. Conch., vol. 17, p. 71, pl. 8, fig. 37.

Shell is long, large, almost straight, and equally curved. The color is a dirty brownish yellow; the texture is chalky, a soft outer layer covering a porcellanous portion, with many shell layers shown in section. There are 50 slightly raised primary riblets with shallow open spaces between, the riblets disappearing anteriorly. No transverse sculpture is present beyond growth line "scratches," becoming "harsh" and "broken" toward the anterior end of the cylinder. There is a short irregular apical fissure on the convex side.

The type is in the British Museum. It measures—length, 50 mm.; diameter, 7.5 mm.

Taken off the mouth of the La Plata River in 1,900 fathoms, blue mud, temperature 33.1° F., *Challenger* Station No. 323.

This species is not represented in the National Museum collection and I have seen no examples. Doctor Watson's description indicates a species very close to *Dentalium meridionale*.

DENTALIUM (FISSIDENTALIUM) MERIDIONALE Pilsbry and Sharp.

In 1884 Professor Verrill published his description of *Dentalium solidum*, a species from deep water off Block Island and the Delaware Capes. A very full series of this large *Dentalium*, including many living examples, had been taken the year before by the *Albatross* from numerous stations off southern New England. Five years later, in reviewing the Scaphopods of the coast, Doctor Dall united this species with the European *D. candidum*, described by Jeffreys in 1877, from northeast Atlantic stations in 410 to 1,750 fathoms. In 1897 Pilsbry and Sharp, in their monograph of the order, accepted Dr. Dall's disposition of Verrill's species, retaining for it Jeffreys's name and relegating "*solidum*" to the synonymy. In the meantime, however, more lots of apparently the same, or at least a very closely allied species, were sent in by the *Albatross*, dredged off Cape Fear, South Carolina, in 731 fathoms; off Jamaica in 966 fathoms; and off the Brazilian coast in 671 fathoms. These later lots Doctor Pilsbry removed from typical *D. candidum* under the subspecific name of *D. c. meridionale*.

Jeffreys's specimens, including his type lot, are now in the National Museum collection, and consist of 10 lots, mostly of fragments, which are scarcely recognizable except when immediately associated with good specimens from the same stations. Besides what appears to be his original series of *D. candidum*, there are two lots of fair but young and immature specimens, one from "Station 28, Porc. Exp. off Hebrides in 1,215 fathoms," and the other of two specimens from off the West Coast of Africa and Azores, taken by the *Talisman* expedition. The shells of the first of these lots answer only fairly well to Jeffreys's composite description; those of the second are obviously of another species and much more closely resemble our own shells from the American coast. A careful comparison of the only really recognizable specimen in the Jeffreys collection that can be accepted as the true *D. candidum* with American shells of the same growth period convinces me of the error of uniting them. Even were the sculptural characters more clearly identical, the shining white compact texture of the British specimen makes questionable its union with the soft, chalky American shells, covered as they all are with an ashy or mouse-colored periostricum. Its rate of increase in diameter is also less and the curvature is not quite the same.

D. candidum Jeffreys, the unnamed Azores specimen, the northern lots of *D. capillosum* Jeffreys, *D. solidum* Verrill, and *D. c. meridionale* Pilsbry and Sharp, are all closely allied species of the same group. It is, however, straining their characters actually to unite them specifically.

I would therefore restore Verrill's name to the American species, but as his name of *solidum* is preoccupied I rename it *verrilli*. Doctor Pilsbry's *meridionale* must then take priority and the group is rearranged as follows:

Dentalium meridionale Pilsbry and Sharp, 1897.

Dentalium meridionale meridionale Pilsbry and Sharp.

Dentalium meridionale verrilli, new name(=*D. solidum* Verrill= *D. candidum* Authors) (not of Jeffreys).

Dentalium meridionale jamaicense, new subspecies.

DENTALIUM (FISSIDENTALIUM) MERIDIONALE MERIDIONALE Pilsbry and Sharp.

Plate 9, fig. 2.

1881. *Dentalium ceras*, Dall, Bull. Mus. Comp. Zool., vol. 9, p. 37 (not *D. ceras* Watson).

1889. *Dentalium ceras*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 425 (not *D. ceras* Watson).

1889. *Dentalium ceras*, Dall, Proc. U. S. Nat. Mus., vol. 12, p. 294 (not *D. ceras* Watson).

1897. *Dentalium* (*Fissidentalium*) *candidum meridionale* Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 73, pl. 15, figs. 32, 33, 34.

The shell is very long, large, solid, and strong, moderately curved, regularly and rather rapidly increasing in diameter and somewhat compressed dorso-ventrally, giving a rounded oval section; an ashen gray or mouse colored periostricum covers a white but not shining surface beneath. The nacreous layer within the shell is bluish white. There are about 16 riblets in the extreme posterior end, separated by wider, shallow, smoothish spaces between. These primary riblets increase to 90 or more flat-topped, gradually broadening riblets, which eventually reduce the intercostal spaces to mere lines and persist with but little effacement to the anterior end of adult specimens. No transverse sculpture beyond fine growth lines is present. The apical features consist of a deep notch placed on the convex side.

Length, 101 mm.; greater diameter, 12.8 mm.; lesser diameter, 12.3 mm.; arc, 5; type.

Length, 108 mm.; greater diameter, 14 mm.; lesser diameter, 13 mm.; arc, 5; Rio de Janeiro.

The type, Cat. No. 87557 (*a*), U.S.N.M., was dredged by the *Albatross* at U. S. B. F. Station 2763, 240 miles south by east from Rio de Janeiro, in 671 fathoms, gray ooze, bottom temperature 37.9° F.

This deep-water subspecies is by far the largest of any of the *Dentalia* so far known from the western Atlantic. The mouse or ashen colored outer shell layer is unique among all species of the area. This subspecies is restricted to the very large, broad forms from off Rio de Janeiro. A worn fragment from Barbados, taken in 100 fathoms, State University of Iowa Expedition, is clearly referable to this subspecies.

The following are the museum collection records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	87557	Southeast of Rio de Janeiro, U. S. B. F. Station 2763.	671 fms., 37.9°, br. glob. oz.
8	314452	Brazil, U. S. B. F. Station 2763	Do.
2	87557	Rio de Janeiro, U. S. B. F. Station 2763	Do.
2	87538	.....do	Do.
1	95353	North of Yucatan Bank, Blake Station 33	1,568 fms.

[1] Type.

DENTALIUM (FISSIDENTALIUM) MERIDIONALE JAMAICENSE, new subspecies.

Plate 9, fig. 4.

1889. *Dentalium candidum*, DALL, Proc. U. S. Nat. Mus., vol. 12, p. 294 (not *D. candidum* Jeffreys).

1897. *Dentalium candidum meridionale* PILSBRY and SHARP (part), Tryon's Man. Conch., vol. 17, p. 73.

The shell differs from the typical subspecies only in being more slender, while possessing the same number and character of riblets.

The specimen selected from a lot of six specimens for the type, Cat. No. 103519, U.S.N.M., was taken at the U. S. B. F. Station 2140, near Jamaica, in 966 fathoms, coral sand, bottom temperature 39.7°. It measures—length, 110 mm.; greater diameter, 11 mm.; lesser diameter, 10 mm.

Also a lot of two specimens, Cat. No. 87556, U.S.N.M., from U. S. B. F. Station 2760, 90 miles north of Caera, Brazil, in 1,019 fathoms, broken coral; bottom temperature, 39.4°.

An intermediate form between this and the northern *Dentalium meridionale verrilli* is met with in 731 fathoms off Cape Fear. The sculpture persists to the oral end, but the shell begins to take on the chalky texture and thicker periostricum so characteristic of the boreal form. This is a lot of five specimens, Cat. No. 93425, U.S.N.M., taken at the U. S. B. F. Station 2678, in 731 fathoms, ooze; bottom temperature, 38.7° F.

DENTALIUM (FISSIDENTALIUM) MERIDIONALE VERRILLI, new name.

Plate 9, fig. 3.

1884. *Dentalium solidum* VERRILL, Trans. Conn. Acad. of Arts and Sci., vol. 6, p. 215, pl. 44, fig. 16 (not *solidum* Hutton, 1873).

1889. *Dentalium candidum*, DALL, Bull. Mus. Comp. Zool., vol. 18, p. 422, in part (not *Dentalium candidum* Jeffreys, 1877).

1889. *Dentalium candidum*, DALL, Bull. 37, U. S. Nat. Mus., p. 76 (not of Jeffreys).

1893. *Dentalium candidum*, BUSH, Bull. Mus. Comp. Zool., vol. 34, No. 6, p. 223 (not of Jeffreys).

1897. *Dentalium candidum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 72, in part, pl. 8, figs. 27, 28 (not figs. 29, 30); pl. 15, figs. 39, 40.

1903. *Dentalium candidum*, DALL, Bull. 37, U. S. Nat. Mus., p. 75 (not of Jeffreys).

The shell is very large, heavy, strong, regularly increasing in diameter, with its chief curvature near the tip or in the posterior third, the balance of the shell being almost straight (variable). The section is round, periostricum thin, shell thickest just back of aperture. Specimens are rather given to abnormalities. It is ashen gray or mouse colored, a glossy periostricum covering a thick chalky white layer beneath, which in turn surrounds an inner nacreous hard layer of a bluish white tint. The outer shell surface is usually worn away in spots, especially about the apical end, leaving exposed the middle soft chalky layer, which is itself quite subject to the destructive chemical action of sea water. The sculpture consists of about 16 to 20 primary riblets, narrower than the spaces they separate; these are increased to double the original number, or more, all becoming broader and flatter, thus reducing the intercostal spaces to mere threads; finally, at about the beginning of the anterior third they fuse into a smooth surface, in which every trace of sculpture is lost, save for some irregular growth lines. The sculptural features are confined to the outer shell layer, and, though superficial, are very noticeable wherever the periostricum is intact. An apical notch as in the typical subspecies is present, but is less deep.

Length, 82 mm.; diameter, 10 mm. (Verrill).

Length, 75 mm.; diameter, 9 mm. (Verrill).

Length, 96 mm.; diameter, 10 mm.; arc, 4.5 (off Chesapeake).

No single specimen seems to have been set apart by Verrill as a type. A selected type, Cat. No. 34687, U.S.N.M., was dredged by the *Albatross* at U. S. B. F. Station 2083, off Georges Banks, in 959 fathoms, gray mud, bottom temperature, 40° F. It measures—length, 80 mm.; diameter, 10 mm.

A large series in the museum collection from off Block Island and Nantucket to Hatteras in 843 to 1,813 fathoms is shown in the following table:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
6	50186	Southeast of Georges Bank, U. S. B. F. Station 2531.	852 fms., 38.4°, gy. m.
17	34904	Off Georges Bank, U. S. B. F. Station 2077......	1,255 fms., 39°, bw. m.
2	34687	Off Georges Bank, U. S. B. F. Station 2083......	959 fms., 40°, gy. m.
1	38149	Off Georges Bank, U. S. B. F. Station 2076......	906 fms., bw. m.
40	34911	Off Georges Bank, U. S. B. F. Station 2084......	1,290 fms., 40°, bw. m. s.
1	52087	Off Georges Bank, U. S. B. F. Station 2570......	1,813 fms., 37°, glob. oz.
2	40394	South of Long Island, U. S. B. F. Station 2234...	810 fms., 39°, gn. m.
1	38634	Off Marthas Vineyard, U. S. B. F. Station 2222..	1,537 fms., 36.9°, gy. oz.
5	34688	Off Marthas Vineyard, U. S. B. F. Station 2094...	1,022 fms., 38.5°, form. s. m.
1	38637	Off Marthas Vineyard, U. S. B. F. Station 2216...	963 fms., 39.5°, gn. m.
1	38110	Off Marthas Vineyard, U. S. B. F. Station 2093...	1,000 fms., 39°, form. s. m.
3	38393	Off Marthas Vineyard, U. S. B. F. Station 2077...	1,255 fms., 39°, bw. m.
8	39985	Off Nantucket, U. S. B. F. Station 2217..........	924 fms., 38.1°, gn. m.
4	39977	Off Nantucket, U. S. B. F. Station 2195..........	1,058 fms., 38.4°, gn. m.
11	34917	Off Nantucket, U. S. B. F. Station 2052..........	1,098 fms., 45°, glob. oz.
10	34916	Off Nantucket, U. S. B. F. Station 2051..........	1,106 fms., 39°, bw. m. glob. oz.
2	34757	Off Nantucket, U. S. B. F. Station, 2050.........	1,050 fms., 49°, glob. oz.
3	39976	Off Nantucket, U. S. B. F. Station 2193..........	1,122 fms., 38.4°, gn. m.
12	39966	Off Nantucket, U. S. B. F. Station 2220..........	1,054 fms., 38.3°, gy. m.
3	51374	Off Nantucket, U. S. B. F. Station 2192..........	1,060 fms., 38°, gy. oz.
11	39983	South of Block Island, U. S. B. F. Station 2209..	1,080 fms., 39.5°, gn. m. s.
33	76829	South of Block Island, U. S. B. F. Station 2748..	1,163 fms., 37.8°, gn. m. form.
6	39984	South of Block Island, U. S. B. F. Station 2210..	991 fms., 38.1°, glob. oz.
12	39979	Block Island, U. S. B. F. Station 2205...........	1,073, fms., 38.1°, gy. oz.
5	39981	Block Island, U. S. B. F. Station 2207...........	1,061 fms., 38.6°, gn. m.
1	51375	Block Island, U. S. B. F. Station 2203...........	705 fms., 38.9°, gn. m. s.
11	78827	Off Delaware Bay, U. S. B. F. Station 2732......	1,152 fms., 38°, dk. gn. m.
7	78829	Off Delaware Bay, U. S. B. F. Station 2733......	944 fms., 38°, gn. m.
6	78826	Off Delaware Bay, U. S. B. F. Station 2734......	841 fms., 38°, sft. gn. m.
2	78973	Off Delaware Bay, U. S. B. F. Station 2735......	811 fms., 38°, sft. gn. m.
7	51377	Off Delaware Bay, U. S. B. F. Station 2230......	1,168 fms., 36.8°, gy. oz.
13	35636	Off Delaware Bay, U. S. B. F. Station 2103......	1,091 fms., 39°, glob. oz.
1	35500	Off Delaware Bay, U. S. B. F. Station 2102......	1,209 sms., 39°, glob. oz.
1	35373	Off Delaware Bay, U. S. B. F. Station 2104......	991 fms., 41.5°, bw. m.
1	78970	Off Chesapeake Bay, U. S. B. F. Station 2727....	1,239 fms., 37°, gy. oz.
6	78972	Off Chesapeake Bay, U. S. B. F. Station 2728....	859 fms., 38°, gy. oz.
5	78971	Off Chesapeake Bay, U. S. B. F. Station 2731....	781 fms., 38°, gy. oz.
2	78907	Off Chesapeake Bay, U. S. B. F. Station 2729....	679 fms., 38°, dk. gn. m.
1	35467	Off Cape Hatteras, U. S. B. F. Station 2116......	888 fms., 39°, bw. m. fne. s.
6	314453	Off Cape Hatteras, U. S. B. F. Station 2111......	938 fms., gn. m.

DENTALIUM (FISSIDENTALIUM) FLORIDENSE, new species.

Plate 10, figs. 1, 2, 6, 7.

1885. *Dentalium capillosum*, Watson, *Challenger* Report Scaphopoda, p. 1, in part. (Not of Jeffreys.)
1889. *Dentalium capillosum*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 425, in part. (Not of Jeffreys.)
1889. *Dentalium capillosum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76. (Not of Jeffreys.)
1897. *Dentalium capillosum*, Pilsbry and Sharp, Tryon's Man. Conch., 17, p. 77, in part and omitting figures on pl. 8. (Not of Jeffreys.)
1903. *Dentalium capillosum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76. (Not of Jeffreys.)

The shell is solid, regularly but not greatly curved and rapidly increasing in diameter. Early part of tip awl-shaped and very slender. The section almost round. Yellowish white in color, porcellanous, but not shining. The tip is hexagonal, the angles pinched up into sharp ridges, separated by smooth slightly concave spaces between. At about 12 mm. from the apex intercalation of one rib in each intercostal space takes place, the six original angles broaden into primary ribs, and the section of the shell becomes round. The ribs increase to 24, become rounded, and of approximately equal importance and are separated by spaces of equal width; all the ribs persist to the oral aperture. The entire surface is covered by wavy growth lines which though more prominent on the posterior portion are always observable. These impart a roughened appearance to the longitudinal ribs which is better seen under a lens. There is a long, narrow apical slit on the convex side.

Length, 62 mm.; greater diameter, 8.5 mm.; lesser diameter, 8 mm.; arc, 3. Type.

Length, 74 mm.; greater diameter, 10 mm.; lesser diameter, 9.75 mm.; arc, 3.

The type, Cat. No. 314457 U.S.N.M., was dredged by the *Eolis* at her Station 301 off Sand Key, Florida, in 95 fathoms, rocky bottom.

Lots from various stations off Key West and Fowey Light, Florida, 35 to 110 fathoms, collected by the *Eolis*, and from Barbados in 100 fathoms, taken by the *Hassler* mark the only museum collection records.

The recent addition to the museum collection of excellent specimens from the edge of the Gulf Stream off the Florida Keys showing perfectly preserved tips as well as living adults, makes possible the definite diagnosis of this somewhat misunderstood species.

A comparison of our shell with Jeffrey's series of *Dentalium capillosum* from North Atlantic stations removes any question of their specific identity. I have not seen Watson's subspecific *D. c. paucicostatum*, but the description of this eastern Atlantic mollusk shows it to be undoubtedly of the same group of *D. floridense*, but not conspecific. The Pourtales shell from the Gulf Stream off Bahia Honda, doubtfully referred to by Watson in the *Challenger* Report as *D. paucicostatum*, is probably *D. floridense*. It is evidently a warm-water species of the continental shelf zones of the Antilles. Watson's specimen from off Culebra Island in 390 fathoms is only a fragment and very difficult of determination.[1] Under such circumstances I do not think it should be accepted as identical with a European species of boreal station.

The following lots are in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	314454	Off Fowey Light, Florida, *Eolis* Station 353	85 fms.
2	314455	Off Western Dry Rocks, Florida, *Eolis* Station 319.	90 fms.
1	314456	Off Key West, Florida, *Eolis* Station 334	90 fms.
2	314457	Off Sand Key, Florida, *Eolis* Station 301	95 fms., rocky (type).
2	314458	Off Sand Key, Florida, *Eolis* Station 323	110 fms.
1	314459	Off Sand Key, Florida, *Eolis* Station 326	75 fms.
1	314460	Off Sand Key, Florida, *Eolis* Station 6	35 fms., sand and broken shells.
2	314461	Off Sand Key, Florida, *Eolis* Station 324	100 fms.
1	95332	Barbados	100 fms. (Hassler).

Subgenus GRAPTACME Pilsbry and Sharp, 1897.

1897. *Graptacme* PILSBRY and SHARP, Tryon's Man. of Conchology, vol. 17, p. 85.

The shell is sculptured with very close, fine, deeply engraved longitudinal striae near the apex, all the balance of the shell being smooth. The apical characters are variable. They constitute a group of small to medium sized shells, generally living in moderate depths. The extent of surface occupied by the sculpture is also quite variable. The chief character of the subgenus is in the very fine engraved lines of the posterior portion, as contrasted with the more prominent ribbing so characteristic of other groups heretofore considered. The tips are never angled. The texture of the shell is usually glassy, with a smooth shining surface in the anterior portion, and the section is always round. The following key to the western Atlantic forms roughly characterizes the few species:

KEY TO THE SPECIES OF THE SUBGENUS GRAPTACME.

- Apical aperture with slit plug.................................... *calamus*, page 72.
- Apical aperture without slit plug.
  - Apical slit on convex side, deep and narrow.
    - With more than 20 longitudinal engraved lines............ *eboreum*, page 66.
    - With less than 20 longitudinal engraved lines....... *circumcinctum*, page 68.
  - Apical slit laterally placed.
    - Large (25 to 34 by 3 to 4 mm.)................... *semistriolatum*, page 69.
    - Small (17 by 1.5 mm.)............................... *amaliense*, page 71.
  - Apical slit doubtfully placed.
    - Vivid zigzag gray color bands.......................... *sericatum*, page 71.

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[1] *Challenger* Report, p. 2.

DENTALIUM (GRAPTACME) EBOREUM Conrad.

Plate 10, figs. 3, 4, 5, 8, 9; plate 11, fig. 6.

1846. *Dentalium eboreum* Conrad, Proc. Acad. Nat. Sci. Phila., vol. 3, p. 27.
1885. *Dentalium leptum* Bush, Trans. Conn. Acad. Arts and Sci., vol. 6, p. 470, pl. 45, fig. 18, 18*a*.
1885. *Dentalium leptum* Bush, Report of Com. of Fish and Fisheries for 1883, p. 586 [84].
1889. *Dentalium leptum*, Dall, Bull. Mus. Comp. Zool., vol. 17, p. 421.
1889. *Dentalium leptum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1889. *Dentalium matara* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 420.
1889. *Dentalium matara* Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1892. *Dentalium leptum*, Dall, Trans. Wagner Free Inst., Phila., vol. 3, pt. 2, p. 440.
1897. *Dentalium eboreum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 89, pl. 16, figs. 47–49, 55, 56.
1897. *Dentalium leptum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 89, pl. 16, fig. 50.
1897. *Dentalium matara*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 105, pl. 18, figs. 14–18.
1901. *Dentalium matara* Dall and Simpson, Bull. U. S. Fish Com. for 1900, vol. 1, p. 456.
1903. *Dentalium leptum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1903. *Dentalium matara* Dall, Bull. 37, U. S. Nat. Mus., p. 76.

The shell is regularly, moderately curved, slender, thin but strong, with a long slightly arched tip. The color is a salmon pink, sometimes yellowish, generally fading to white, first on the anterior portion, then finally over the entire shell in all but fresh specimens. The surface is highly polished, shining and vitreous, though often variegated with milky, less translucent patches. The sculpture is confined to the tip only and consists of about 20 very fine raised longitudinal lines, visible only under a lens; all the balance of the shell is perfectly smooth save for slight growth irregularities. There is a rather deep, narrow apical notch on the convex side. In old specimens where the tip has been lost a projecting thin sheath of the inner shell layer from the posterior aperture is frequently developed, and in this case the apical slit is preserved and reproduced in the protruding sheath, and it is sometimes even repeated, though in lesser degree, on the concave side as well. Average specimens measure—length, from 25 to 35mm.; diameter, 2.5 mm.; with an arc of 2. An adult specimen of large size with tip intact would measure about—length, 62–65 mm.; diameter, 3 mm.; with an arc of 3.5 to 4.

The type of *Dentalium eboreum* is in the collection of the Philadelphia Academy of Sciences; topotypes in museum collection, Cat. No. 152957, U.S.N.M., are from Sarasota Pass, Florida.

The type of *Dentalium leptum*, Cat. No. 41562, U.S.N.M., are from off Hatteras, in 16 fathoms, from the U. S. B. F. Station 2276; bottom of gray sand and broken shells.

The type of *Dentalium matara*, Cat. No. 95363, U.S.N.M., off Cape Lookout, in 31 fathoms, bottom of black sand and broken shells, from the U. S. B. F. Station 2611.

In the National Museum collection are many lots from off Cape Hatteras, Beaufort, Cape Lookout, from the Florida east coast region in shallow water, 6 to 49 fathoms; from the Florida Keys region, 18 to 50 fathoms; west coast of Florida shore stations to 111 fathoms; also from San Juan, Porto Rico, and Barbados.

A lot from Samana Bay, consisting mostly of fragments, are not typical, being more strongly curved.

Conrad's *Dentalium eboreum* seems to have been overlooked until redescribed by Pilsbry and Sharp in 1897. Conrad's specimens showed no notch. We now know the absence of apical characters to be of frequent occurrence in many of the *Dentalia*. On account of its insufficient description, Miss Bush evidently discarded Conrad's species when determining the status of her own *D. leptum*.

Practically all large, fully adult or senile specimens lose the entire tip, leaving a perfectly smooth, highly polished sculptureless shell. This is Dall's *Dentalium matara*. I have only been willing to unite these three species after a most critical examination of many lots, and I do not believe them to be separable even subspecifically.

The following lots are in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	35379	Off Cape Hatteras, U. S. B. F. Station 2112......	15.5 fms., 73.5° s. blk. sp. (type of *leptum*).
1	41562	Off Cape Hatteras, U. S. B. F. Station 2276......	16 fms., gy. s. brk. sh. (fig'd. spec. *leptum*).
5	322475	Off Cape Hatteras, U. S. B. F. Station 2112......	15 fms., 73.5°, s. blk. sp.
19	41542	Off Cape Hatteras, U. S. B. F. Station 2292......	17 fms. (mostly fragments), gy. s. brk. sh.
30	44452	Off Cape Hatteras, U. S. B. F. Station 2278......	16 fms. (tips and fragments), gy. s. brk. sh.
35	45193	Off Cape Hatteras, U. S. B. F. Station 2275......	16 fms. (young), gy. s. brk. sh.
60	40777	Off Cape Hatteras, U. S. B. F. Station 2277......	16 fms. (mostly young), gy. s. brk. sh.
1	93111	Off Cape Hatteras, U. S. B. F. Station 2269......	49 fms., 77°, crs. bl. gy. s.
8	92828	Off Cape Hatteras, U. S. B. F. Station 2295......	22 fms., 73.5°, crs. gy. s.
1	322720	Off Cape Hatteras, U. S. B. F. Station 2277......	16 fms., gr. s. brk. sh.
4	44453	Off Cape Hatteras, U. S. B. F. Station 2280......	16 fms. gy. s. brk. sh.
42	45192	Off Cape Hatteras, U. S. B. F. Station 2273......	17 fms., 72.3° (mostly tips and fragments), gy. s. brk. sh.
22	41562	Off Cape Hatteras, U. S. B. F. Station 2276......	16 fms. (mostly young), gy. s. brk. sh.
8	45191	Off Cape Hatteras, U. S. B. F. Station 2272......	15 fms. (young), gys. s. blk. sp.
50+	93112	20 miles southwest by south from Hatteras, U. S. B. F. Station 2597.	15 fms., sand (young).
40+	35860	Off Hatteras, U. S. B. F. Station 2112...........	15 fms. crs. gy. s.
7	35788	Off Hatteras, U. S. B. F. Station 2114...........	15.5 fms., 73.5°, s. blk. sp.
3	40884	Off Hatteras, U. S. B. F. Station 2289...........	14 fms., 72° (fragments), m. blk. s.
7	44451	Off Hatteras, U. S. B. F. Station 2269...........	7 fms., crs. s. blk. sp.
40+	41585	Off Hatteras, U. S. B. F. Station 2276...........	48 fms., 77°, crs. gy. blk. s.
25	198151	Off Hatteras, U. S. B. F. Station................	16 fms., (?) gy. s. brk. sh.
14	250180	Off Hatteras, U. S. B. F. Station 2601...........	16 fms., (?) gy. s. brk. sh.
5	41466	Off Hatteras, U. S. B. F. Station 2291...........	87 fms., 71.5°, fine gy. s.
11	35380 and 35392	Off Hatteras, U. S. B. F. Station 2113...........	15 fms., gy. s. blk. sp.
1	95363	Off Cape Lookout, U. S. B. F. Station 2611......	15 fms., 72.5°, m. blk. s.
8	93114	Off Cape Lookout, U. S. B. F. Station 2608......	31 fms., 74° (type of *matara*), blk. s. brk. sh.
1	329954	.....do	22 fms., 78.2°, crs. gy. s.
2	330118	Off Cape Lookout, U. S. B. F. Station 2611......	22 fms., crs. gy. s. sh., 78.2°.
13	93113	Off Cape Lookout, U. S. B. F. Station 2607......	31 fms., brk. sh. blk. s., 74°.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
4	93116	Off Cape Lookout, U. S. B. F. Station 2612	18 fms., 73.5°, fine gy. s.
20	92821	Off Cape Lookout, U. S. B. F. Station 2610	52 fms., 67°, crs. wh. s.
5	92824	Off Cape Lookout, U. S. B. F. Station 2611	22 fms., 78.8°, wh. s. blk. sp.
2	92823	Off Cape Lookout, U. S. B. F. Station 2608	31 fms., 74°, blk. s. brk. sh.
2	314295	Off Beaufort, North Carolina, U. S. B. F. Station D7960.	22 fms., 75.5°, crs. gy. s.
44	314296	Off Beaufort, North Carolina, U. S. B. F. Station D7966.	14.5 fms., crs. s. sh.
6	314297	Off Bogue Inlet, North Carolina, U. S. B. F. Station D7997.	9.5 fms., gy. s. sh.
3	314298	Beaufort, North Carolina, U. S. B. F. Station B1415.	9.5 fms., s. sh.
105	314299	Beaufort, North Carolina, *Eolis* Station 21	6–9 fms.
9	314300	Cape Lookout Bight, North Carolina, *Eolis* Station 20.	3 fms.
8+ frag.	98118	Off Cape Fear, North Carolina, U. S. B. F. Station 2619.	15 fms., crs. yl. s. rot. co.
4	93117	Off Cape Fear, North Carolina, U. S. B. F. Station 2615.	18 fms., (fragments), gy. s.
15	382987	12 miles east of Frying Pan Shoals, Florida	12 fms. (Dr. Rush).
2	14301	12 miles east of Frying Pan Shoals, Florida (Ford collection).	12½ fms.
2	314302	Off Miami, Florida, *Eolis* Station 51	24 fms.
1	314303	Off Miami, Florida, *Eolis* Station 139	30 fms.
1	314304	Off Miami, Florida, *Eolis* Station 48	60 fms.
1	314305	Off Miami, Florida, *Eolis* Station 103	20 fms.
1	314306	Off Miami, Florida, *Eolis* Station 113	18–20 fms.
1	314307	Off Fowey Light, Florida, *Eolis* Station 119	23 fms.
4	314308	Off Turtle Harbor, Florida, *Eolis* Station 61	40 fms. (fragments).
1	314309	Off Turtle Harbor, Florida, *Eolis* Station 59	20 fms.
8	314310	Off Key West (Gulf), Florida, *Eolis* Station 102	10 fms.
7	14311	Off Key West (north), Florida, *Eolis* Station 30	7 fms.
1	95364	Between Tampa and Tortugas, U. S. B. F. Station 2409.	26 fms., crs. gy. s. brk. sh.
1	228738	Sanibal Island, (Ford collection).	
2	314312	Sanibal Island.	
14	228737	Sanibal Island (W. F. Clapp collection)	(W. F. Clapp).
7	152957	Sarasota Pass, Florida (beach)	(Post) (topotypes).
7	194635	Off Anclote Light, Florida, U. S. B. F. Station 7106.	12.5 fms., r. co. s. 63°.
1	195151	West coast of Florida, U. S. B. F. Station 5109	24 fms., 67° (Grampus).
1	83782	Charlotte Harbor, Florida (Dall)	
3	53908	Marco, Florida	2 fms. (H. Hemphill).
2	108797	Marco, Florida	(O. Tollin).
5	95366	Cape Romaine, Florida (Stearns collection)	(E. Jewett).
2	314313	Off coast of San Blas, U. S. B. F. Station 2369	26 fms., crs. gy. s. brk. sh
1	94095	Between Mississippi Delta and Cedar Keys, U. S. B. F. Station 2402.	111 fms., gy. m.
1	161575	San Juan Harbor, Porto Rico	
7	95365	Samana Bay, Santo Domingo	16 fms.
4	314824	Money Island Bay, Beaufort, North Carolina, B. 1413.	2 fms.
1	314825	Money Island Bay, Beaufort, North Carolina, U. S. B. F. Station 7328.	Steamer *Fish Hawk*.
2	314900	Antigua, Falmouth Harbor, S. U. I. Exp. Station 105.	3 to 5 fms., sand and mud.

DENTALIUM (GRAPTACME) CIRCUMCINCTUM Watson.

Plate 11, fig. 7.

1879. *Dentalium circumcinctum* Watson, Journ. Linn. Soc. London, vol. 14, p 513.

1886. *Dentalium circumcinctum* Watson, *Challenger* Report, Scaphopoda, p. 7, pl. 1, fig. 7.

1897. *Dentalium* (*Graptacme*) *circumcinctum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 88, pl. 8, fig. 26.

The shell is very long and slender, slightly curved, the arc mostly in the posterior portion; a little flattened on the concave curve, giving to the shell a slightly trigonal section; it is strong but not thick. The color is white, texture opaquely porcellanous, with a glossy surface. There are 17 to 20 fine longitudinal riblets separated by broader intercostal spaces; intercalation of secondary riblets increases the original number and all finally decrease in definiteness and merge into a rounded surface. Growth lines, "scratch-like puckerings," are present, about 55 to each one-tenth inch. The apical feature consists of an irregular ragged fissure on the convex side.

Length, 1.93 inches; diameter 0.13 inch (49.02 mm. by 3.3 mm.).

The type is in the British Museum collection. This species is quoted by Watson as occurring on both sides of the Atlantic, the western Atlantic records being off Sombrero Island in 470 fathoms, *Challenger* Station 23; off Bermuda in 1,075 fathoms, *Challenger* Station 56, and off Pernambuco in 350 fathoms, *Challenger* Station 122.

There are no examples in the National Museum collection, nor have I seen specimens. The description suggests a shell belonging to the group of *Dentalium bartletti.*

DENTALIUM (GRAPTACME) SEMISTRIOLATUM Guilding.

Plate 11, figs. 1, 2, 3, 8, 9.

(?) 1819. *Dentalium semistriatum* Turton, Conch. Dict. British Isles, p. 39, pl. 18, fig. 68.

(?) 1825. *Dentalium nebulosum* Deshayes, Mem. Soc. Hist. Nat., Paris, vol. 2, p. 369, pl. 16, fig. 20 (Not of Gmelin).

1834. *Dentalium semistriolatum* Guilding, Trans.Linn. Soc., London, vol. 17, pt. 1, p. 34, pl. 3, figs. 1–5.

(?) 1843. *Dentalium translucidum* Chenu, Conch. Ill., vol. 1, p. 8, pl. 3, fig. 12 (Not of Deshayes).

(?) 1843. *Dentalium nebulosum,* Chenu, Conch. Ill., p. 5, pl. 6, fig. 4.

1843. *Dentalium semistriolatum,* Chenu, Conch. Ill., p. 7, pl. 4, figs. 14, 15.

1843. *Dentalium semistriatum,* Forbes and Hanley, Hist. Brit. Moll., vol. 2, p. 454.

(?) 1860. *Dentalium nebulosum,* Sowerby, Theasurus, vol. 3, p. 98, pl. 225, fig.58.

(?) 1873. *Dentalium nebulosum,* Sowerby, Reeve Conch. Icon., vol. 18, pl. 7, fig. 53.

(?) 1896. *Dentalium nebulosum,* Clessin, Syst. Conch. Cab., vol. 6, pt. 5, p. 19, pl. 5, fig. 5.

(?) 1897. *Dentalium* (*Graptacme*) *semistriatum,* Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 90, pl. 16, fig. 51, 52, 53.

In selecting Guilding's name from a somewhat confused synonymy I have taken the first that is expressly quoted from the Antilles, and which is also accompanied by a figure and description which leave no reasonable grounds for doubt. Deshayes's and Chenu's *Dentalium nebulosum,* especially as interpreted by Sowerby in the Thesaurus and in Reeve, seems likely to be this species, despite the vagueness of the localities given, some of which, however, are Antillean. Turton's *D. semistriatum,* as pointed out by Forbes and Hanley, is merely "exotic" and it may be this species. Chenu's *D. translucidum* (not of Deshayes nor of Sowerby in Reeve) is very suggestive, but is left without definite locality and may or may not be our species. I have excluded references to Pacific forms, generally regarded as synonymous, as I believe them to be distinct from our species.

These are *Dentalium semipolitum* Pilsbry and Sharp, *D. liratum* Carpenter, *D. liratulum* Mörch, etc. Whatever the others with more or less doubt may represent there can be no question that Guilding's *D. semistriolatum* does represent this very common shallow-water Antillean species. The shell is rather strongly and regularly curved, slender and regularly tapering, and has a round section. The color is translucent white with milky patches; it is highly polished and shining, with sometimes a reddish tint about the apex. Zigzag color bands of an opaque milky white encircle the shell, especially upon its sculptured portion, imparting a watered-silk appearance; this feature, however, varies considerably in degree of prominence. The sculpture consists of fine longitudinal, regularly spaced grooves engraved upon the posterior third, fourth, or fifth portion of the shell, the lines all abruptly ending at a given point, the balance of the shell surface being glistening and smooth but for slight irregularities of growth. There is a long, narrow apical slit on the side about midway between a convex side and concave side position. Many specimens do not show this character.

Dimensions vary within fairly broad limits; the extremes are:

Length, 34 mm.; diameter, 4 mm.; arc 3 (St. Thomas).
Length, 33 mm.; diameter, 2.5 mm.; arc, 2.5 (North Cuba).
Length, 25 mm.; diameter, 3 mm.; arc, 2 (St. Martin).

This is an abundant littoral species found throughout the Caribbean region, more especially in the Lesser Antilles. Lots in the National Museum collection are from Barbados, St. Martin, St. Thomas, Dominica, Varadero (Cuba), Bimini, also from the Florida Keys region, Tortugas to Miami, shore to 30 fathoms, and the west coast of Florida in shallow water. It has not, however, been reported from the Hatteras region.

The following are the National Museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	94378	Bermuda	(Goode.)
10	314462	North Bimini Island, *Eolis* Station 50	20 fms. (fragments).
4	314463	Varadaro Beach, Cuba, *Barrera* Station 213	(beach.)
1	95362	Samana Bay, St. Domingo (Dall)	
17	314464	St. Martin	
1	107711	St. Thomas (Pilsbry)	
1	314465	West Indies (Sowerby and Fulton)	
1	194635		
1	19725	Barbados	
1	19727	do	
1	314466	Off Miami, Florida, *Eolis* Station 49	30 fms., s. co. detr.
4	314467	Off Miami, Florida, *Eolis* Station 62	20 fms.
1	314468	Off Miami, Florida, *Eolis* Station 312	25 fms.
5	314469	Off Fowey Light, *Eolis* Station 8	25 fms.
1	314470	Off Fowey Light, *Eolis* Station 121	30 fms.
1	314471	Sand Key, Florida, *Eolis* Station 98	70–90 fms.
3	314472	Tortugas, Florida, *Eolis* Station 34	15 fms.
5	314473	Tortugas, Florida, *Eolis* Station, 33	(T. E. Benedict.)
2	194902	West Coast, Florida	
1	314474	Key West (North Florida), *Eolis* Station 20	7 fms.
1	194901	West Coast	10–12 fms. (T. E. Benedict).
2	314901	Habana, Cuba	Sanchez.

DENTALIUM (GRAPTACME) AMALIENSE, new species.

Plate 11, figs. 4, 5.

A lot of nine excellent specimens in the National Museum collection at first I had considered to be a small race of *Dentalium semistriolatum*. The particular form of that species occurring in St. Thomas is, however, rather larger and stouter than the average of specimens from elsewhere. These specimens, on the contrary, are hardly more than half the usual size of Guilding's species, and upon a critical comparison seem to lack certain characters necessary to link them even subspecifically. The shell is moderately and regularly curved, slender, regularly tapering, and has a round section. It is translucent to transparent, white in color, with a polished shining surface. It has no trace of the zigzag color bands. The sculpture consists of exceedingly fine longitudinal, regularly spaced grooves, engraved upon the posterior fourth or fifth of the shell, the sculpture disappearing into a smooth, glassy surface. A long narrow apical slit laterally placed is a feature that is not always observable even in apparently perfect specimens.

The measurements are:

Length, 16 mm.; diameter, 1.5 mm. (type).

Length, 17 mm.; diameter, 1.5 mm.

The type, Cat. No. 250088, U.S.N.M., is from St. Thomas, taken from a lot of nine specimens (Petit).

This species is distinguished from *Dentalium semistriolatum* by the relatively reduced space occupied by the sculptural features, by its smaller size, and by the absence of any trace of zigzag color markings. Its degree of curvature is also less. The lateral apical slit at once separates it from *D. eboreum*. Like *D. semistriolatum* it is probably a littoral species of the Antillean region, but of very restricted range.

DENTALIUM (GRAPTACME) SERICATUM Dall.

Plate 12, figs. 1, 6.

(?) 1834. *Dentalium semistriolatum* var. *b*. Guilding, Trans. Linn. Soc. London, vol. 17.

1881. *Dentalium sericatum* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 37

1889. *Dentalium sericatum* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 423, pl. 26, fig. 1.

1889. *Dentalium sericatum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 26, fig. 1.

1897. *Dentalium* (*Graptacme*) *sericatum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 86, in part (not pl. 16, figs.), pl. 7, fig. 12.

1903. *Dentalium sericatum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 26, fig. 1.

This species in known by the type only. It is an immature shell, answering to the description of *Dentalium semistriolatum* except in being more slender and more delicately marked, the zigzag color zones of opaque white being especially bright and noticeable. It has no apical notch or slit. I suspect this to be a race of Guilding's species belonging properly to a shallower zone than that of 640 fathoms and normally possessed of a lateral apical slit. Until more material is at hand Doctor Dall's species had best not be disturbed. Doctor Dall has himself suggested that so small and sharp a shell might easily be caught in the meshes of the *Blake's* dredge net and remain some time before finally being dislodged and washed into the sieves. The following are the essentials of the description:

The shell is small, thin, slightly curved, rather rapidly enlarging with round section. The color is a translucent white, with opaque white wavy lines encircling the shell, with zigzag markings and producing an effect suggestive of *moire antique* silk. The sculpture is of fine sharp close-set longitudinal grooves with narrower spaces between—36 in the middle and about 50 at the oral end. The apertures are simple and featureless.

The type, Cat. No. 203191, U.S.N.M., is a juvenile shell and unique specimen and measures—length, 13 mm.; diameter, 1.2 mm. It was dredged by the *Blake*, station not given, in 640 fathoms, off Yucatan Bank.

DENTALIUM (GRAPTACME) CALAMUS Dall.

Plate 12, figs, 7, 8.

1889. *Dentalium calamus* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 421.
1889. *Dentalium calamus* Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1892. *Dentalium calamus* Dall, Trans. Wagner Free Inst. Phila., vol. 3, pt. 2, p. 440.
1897. *Dentalium* (*Graptacme*) *calamus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 16, p. 97, pl. 16, figs. 55–59.
1903. *Dentalium calamus* Dall, Bull. 37, U. S. Nat. Mus., p. 76.

The shell is slender, slightly curved, evenly and regularly increasing in diameter from a rather blunt posterior end. The color is a translucent white, surface rather polished and vitreous in the anterior portion. It is longitudinally grooved for the greater part of its adult length with uniform regular lines, about 16 to the millimeter, all rather abruptly terminating and leaving the balance of the shell smooth. The relative portions of sculptured and smooth surface are somewhat variable, depending upon the amount of tip lost and age of specimens. The posterior aperture is filled with a slit plug, obliqely planed down on the convex side and therefore showing more of the slit at the dorsal side. The apical plug is polished and seems to form an integral part of the original shell, and not to be a casual eature like the projecting tube so frequently seen in certain other species heretofore considered. The phallic appearance presented by this slit plug is very striking and is unknown in any other species from the faunal areas under consideration. Specimens measure:

Length, 19.5 mm.; diameter, 1.25 mm.; arc, 1.25 (type).
Length, 26 mm.; diameter, 2.1 mm.; arc, 1.5 (Cape Cajon, Cuba).
Length, 24.5 mm.; diameter 1.75 mm.; arc, 1.25 (Porto Rico).

The type, Cat. No. 68117, U.S.N.M., was collected by Commander Rush United States Navy, in Turtle Harbor, Florida, in 4 fathoms.

Specimens from off Cape Fear and Frying Pan Shoals are in the Philadelphia Academy of Sciences collection. The most southern record is of specimens from Barbados, in the State University of Iowa collection. It is a species of very shallow water range.

The lots in the museum collection are as follows:

Number of specimens.	Cat. No. U. S. N. M.	Locality.	Remarks.
7	314475	Miami, Florida, *Eolis* Station 85	6 fms.
1	314476	Miami. Florida, *Eolis* Station 93	18–25 fms.
6	314477	Miami, Florida, *Eolis* Station 83	3 fms.
27	314478	Off Fowey Light, *Eolis* Station 88	6 fms.
[1]5	68117	Turtle Harbor	4 fms. (Rush.)
16	314479	Couch Key, *Eolis* Station 64	1–5 feet.
19	314480	South Binimi Island, *Eolis* Station 72	Shore drift (mostly fragments).
13	314481	South Cat Cay, Bahamas, *Eolis* Station 47	3 fms.
5	314482	Off Arroyos, northwest Cuba, *Barrera* Station 206	
2	314483	Cape San Antonio, Cuba, *Barrera* Station 224	
10	314484	Cape Cajon, Cuba, *Barrera* Station 211	
1	161579	Mayaguez, Porto Rico, U. S. B. F. Station 60–61	12 fms.

[1] Type.

Subgenus LAEVIDENTALIUM Cossman, 1888.

1888. *Laevidentalium* COSSMAN, Ann. de la Soc. Royal de Malac. de Belgique, vol. 25, p. 9.

1897. *Laevidentalium*, PILSBRY and SHARP, Tryon's Manual of Conchology, vol. 17, p. 97.

Shell smooth or showing growth lines only; wholly without longitudinal sculpture. Slightly oval or round section. The apex is simple, as defined by Cossman, or with Antalis-like notch on the convex side, as expanded by Pilsbry and Sharp.

Cossman's subgenus was created for a fossil group of smooth shells showing no apical features. Pilsbry and Sharp are fully justified in including certain recent species showing the conventional apical features of *Antalis*. The essence of the characters for the group lies in the wholly sculptureless shell which is even smooth on the tip.

KEY TO THE SPECIES OF THE SUBGENUS LAEVIDENTALIUM.

Very strongly curved .... *callipeplum*, page 74.
Not very strongly curved.
  Shell slender.
    Very long (over 50 mm.) .... *perlongum*, page 75.
    Not very long (under 50 mm.) .... *liodon*, page 76.
      Apical notch on convex side .... *liodon liodon*, page 76.
      Apical notch on concave side .... *liodon alloschismum*, page 77.

DENTALIUM (LAEVIDENTALIUM) CALLIPEPLUM Dall.

Plate 12, fig. 5.

1889. *Dentalium callipeplum* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 419, pl. 27, fig. 12 (*b*).

1889. *Dentalium callipeplum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 12 (*b*).

1892. *Dentalium callipeplum* Dall, Trans. Wagner Free Inst. Phila., vol. 3, pt. 2, p. 442.

1897. *Dentalium* (*Laevidentalium*) *callipeplum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 100, pl. 19, fig. 9.

1901. *Dentalium callipeplum* Dall and Simpson, Bull. U. S. Fish Comm. for 1900, vol. 1, p. 456.

1903. *Dentalium callipeplum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 12 (*b*).

The shell is strongly, evenly curved like a scimitar and rather rapidly increasing in diameter, thin but strong; its section is round. In color it is ivory or cream white, with some translucent patches, and occasionally reflects a salmon tint on the tip and in the posterior portion. The surface is very highly polished and shining. It is entirely sculptureless; some growth lines appear as mere scratches, but are difficult to distinguish on the glistening vitreous surface. A shallow apical notch on the concave side is faintly indicated. It measures—length, 62 mm.; diameter, 5 mm.; arc 7 (type). The size is very uniform; the other museum specimens which measure less are smaller only because younger.

The type, Cat. No. 94064, U.S.N.M., is from the U. S. B. F. Station 2400, between the Mississippi River delta and Cedar Keys, in 169 fathoms, gray mud, no temperature record given.

This is a very striking shell, with a conspicuously high degree of curvature, exceptionally brilliant glistening surface, and notable for its ivory cream white color rather than the more usual bluish white of most other species of *Dentalium*. These features, combined with the total absence of any sculpture, make it easily recognized.

The following are the museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 5	94064	Between Mississippi Delta and Cedar Keys, U. S. B. F. Station 2400	169 fms., gy. m.
1	95361	Santa Lucia, U. S. B. F. Station 220	116 fms., 58.5°, r.
1	224976	St. Kitts, U. S. B. F. Station 149	61 fms., fne. s. br. sh., 76°.
1	323903	Off Cape San Blas, Florida, U. S. B. F Station 2402	111 fms., gn. m.
2	161578	Mayaguez, Porto Rico, U. S. B. F. Station 6062	25 fms., s. m. sh., 75 8°.

[1] Type.

DENTALIUM (LAEVIDENTALIUM) PERLONGUM Dall.

Plate 9, fig. 1.

1878. *Dentalium perlongum* Dall, Bull. Mus. Comp. Zool., vol. 5, No. 6, p. 61 (name only).
1881. *Dentalium perlongum* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 36.
1888. *Dentalium perlongum*, Agassiz, Three Cruises of the *Blake*, vol. 2, p. 76, fig. 284.
1889. *Dentalium perlongum* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 419, pl. 27, fig. 6.
1889. *Dentalium perlongum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 6.
1889. *Dentalium perlongum* Dall, Proc. U. S. Nat. Mus., vol. 12, p. 294.
1897. *Dentalium* (*Laevidentalium*) *perlongum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 104, pl. 18, figs. 10, 11.
1903. *Dentalium perlongum* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 6.

The shell is extremely long and slender, but slightly arched or almost straight, thin but strong, slowly and regularly increasing in diameter, with round section, and possessing a long needle-like tip. It is opaque white, with a glossy, rather porcellanous but not highly polished surface. Dead specimens take on a light brownish gray or slate color. It is wholly sculptureless, save for some excessively fine longitudinal scratches on the tip and posterior portion, only observable by aid of a lens but more often lacking even in perfectly fresh specimens. Otherwise it is a perfectly smooth cylinder barring the unimportant growth irregularities. A shallow to rather deep apical notch on the convex side is present in normal specimens. The measurements are:

Length, 90 mm.; diameter, 3.75 mm.; arc, 2 (tip gone).

Length, 54 mm.; diameter, 3 mm.; arc, 1.2 (tip gone).

A perfect adult specimen would exceed 100 mm. in length, with a diameter of under 4 mm.

The type is not in United States National Museum collection.

A defective specimen from 20 fathoms southeast of Cape St. Roque, Brazil, and some fragments from off Rio de la Plata, in 11½ fathoms, seem to be referable to this species.

The extreme length, slenderness, and straightness of this shell set it apart from any other species of the western Atlantic.

The following lots are in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
9	94182	Off Cape Hatteras, U. S. B. F. Station 2117	683 fms., yl. m. fne. s., 39°.
1	83803	Between Mississippi Delta and Cedar Keys, U. S. B. F. Station 2384.	940 fms., gy. m., 39.6°.
17	93775	Between Mississippi Delta and Cedar Keys, U. S. B. F. Station 2383.	1,181 fms., br. gr. m.; 39.8°.
3	93149	.....do	Do.
7	223660	.....do	Do.
2	103471	Gulf of Mexico, U. S. B. F. Station 2381	1,330 fms., lt. br. m.
2	95356	St. Vincent, U. S. B. F. Station 226	424 fms., fne. dk. s., 42.5°.
14	87552	South of St. Kitts, U. S. B. F. Station 2751	687 fms., oz., 39.9°.
2	330760	.....do	687 fms., bu. glob. oz., 39.9°.
15	87554	East of Tabago, U. S. B. F. Station 2754	880 fms., 37.9°, glob. oz.
1	95357	Grenada, West Indies, U. S. C. S. Station 244	792 fms., gy. oz., 39°.
2	95359	Guadeloupe, U. S. C. S. Station 163	769 fms., 40° oz. s.
2	95358	Guadeloupe, U. S. C. S. Station 162	734 fms., 40° lava s.
2	96599	North of Ceara, Brazil, U. S. C. S. Station 2760	1,019 fms., 39.4° br. co.
1	203106	Cape St. Roche, U. S. C. S. Station 2758	20 ms., br. sh.
2	330835	Off Rio de la Plata, U. S. C. S. Station 2764	11½ fms., s. sh. brk.

DENTALIUM (LAEVIDENTALIUM) LIODON **Pilsbry and Sharp.**

1897. *Dentalium* (*Laevidentalium*) *liodon* PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 107, pl. 21, figs. 37–39.

The shell is moderately curved, rather slender, thin but strong, with a subcircular aperture, a little dorso-ventrally compressed. Color bluish white, subtranslucent, but more opaque in the middle portion; the surface is brilliantly polished. It is sculptureless, save for occasional circular grooves indicating growth lines. A narrow V-shaped apical notch on the convex or the concave side, or even more or less laterally placed, is a peculiarly variable feature.

The type, in the Philadelphia Academy of Sciences, is from St. Martin (E. Marie) and measures—length, 25.3 mm.; diameter, 2 mm.

This species may be at once distinguished from *Dentalium callepeplum* by its smaller size and lesser degree of curvature, from *D. perlongum* by its shorter shell. *D. liodon* is a shallow to moderately deep water mollusk.

DENTALIUM (LAEVIDENTALIUM) LIODON LIODON **Pilsbry and Sharp.**

Plate 12, figs. 2, 3, 4.

The description of this, the typical subspecies of *Dentalium liodon*, coincides with that of the species itself, with the restriction, however, to those forms only that have the apical notch on the convex side.

The type, which is in the Philadelphia Academy of Sciences, is the same as of *D. liodon* and measures—length, 25.3 mm.; diameter, 2 mm.

The museum lots are: One specimen, Cat. No. 61188, U.S.N.M., was collected by C. T. Simpson in Honduras, and is a beach shell; one specimen, Cat. No. 19729, U.S.N.M., from Barbados; one specimen, Cat. No. 341902, U.S.N.M., was taken by the State University of Iowa Expedition of 1918 at their station 49, off Bridgetown, Barbados, in 80 fathoms; one specimen, Cat. No. 314903, U.S.N.M., from the same expedition, at their station 116, in 200 fathoms, off English Harbor, Antigua.

DENTALIUM (LAEVIDENTALIUM) LIODON ALLOSCHISMUM **Pilsbry and Sharp.**

Plate 13, figs. 1, 4, 5, 6.

1897. *Dentalium* (*Laevidentalium*) *liodon* "variety?" *alloschismum* Pilsbry and Sharp, Tryon's Man. of Conch., vol. 17, p. 108, pl. 21, figs. 40, 41, 42.

The shell differs from *Dentalium liodon liodon* only in the position of the apical notch, which here may be on the concave side or more or less laterally placed, and also by its circular section. Doctors Pilsbry and Sharp questioned the value of the subspecies. A larger series of specimens for study would likely disprove the need of any subspecies under *D. liodon*.

The type, which is in the collection of the Philadelphia Academy of Sciences, is from St. Martin, in the West Indies, and measures—length, 24.5 mm.; diameter, 1.9 mm. Another specimen is—length, 27.5 mm.; diameter, 2.2 mm.

There are no examples in the National Museum collection.

Subgenus EPISIPHON Pilsbry and Sharp, 1897.

1897. *Episiphon* Pilsbry and Sharp, Tryon's Man. of Conch., vol. 17, p. 177.

Shells are very small, slender, and rather straight, needle-shaped, slightly tapering, thin and fragile, glossy and smooth, and without longitudinal sculpture. The apex has a projecting "pipe" or is a simple orifice with no slit or rarely a notch.

This subgenus was created to include a group of very small needle-like *Dentalia*, wholly lacking in any longitudinal sculpture, and possessing to a marked degree a projecting thin tube from the posterior orifice, after the tip is destroyed or lost. This last feature is likely not a biologic one and is by no means confined to this particular subgenus, but it does seem to be a very striking characteristic of the only species of the subgenus occurring in the western Atlantic. Only one species, *Dentalium sowerbyi*, with its two subspecies, *D. s. sowerbyi* and *D. s. pelliceri*, occur within the faunal areas under consideration.

KEY TO THE SUBSPECIES OF THE SUBGENUS EPISIPHON.

Surface coarser, less transparent, American.................. *D. s. sowerbyi*, page 79.
Surface smoother, more transparent, Cuban.................. *D. s. pelliceri*, page 80.

DENTALIUM (EPISIPHON) SOWERBYI **Guilding.**

1834. *Dentalium sowerbyi* Guilding, Trans. Linn. Soc. London, vol. 17, p. 35, pl. 3, fig. 7.

(?)1860. *Dentalium filum* Sowerby, Thesaurus Conch., vol. 3, p. 89, pl. 225, fig. 45.

(?)1860. *Dentalium fistula* Sowerby, Thesaurus Conch., vol. 3, p. 99, pl. 225, fig. 62.

(?)1870. *Dentalium gracile* Jeffreys, Ann. and Mag. Nat. Hist., ser. 4, vol. 6, p. 74.

(?)1880. *Dentalium gracile* Jeffreys, Ann. and Mag. Nat. Hist., ser. 5, vol. 6, p. 317.

1889. *Dentalium filum*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 419.

1889. *Dentalium filum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76.

1892. *Dentalium filum*, Dall, Trans. Wagner Free Inst., Phila., vol. 3, p. 44.

(?)1896. *Dentalium filum*, Clessin, Conchylien Cab., vol. 6, pt. 5, p. 8, pl. 4, fig. 5.

(?)1896. *Dentalium fistula*, Clessin, Conchylien Cab., vol. 6, pt. 5, p. 22, pl. 6, fig. 10.

1897. *Dentalium sowerbyi*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 117, pl. 20, fig. 30.

(?)1897. *Dentalium fistula*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 118, pl. 18, fig. 4.

1897. *Dentalium filum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 118, pl. 18, fig. 9, in part.

1903. *Dentalium filum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76 (not *D. sowerbyi* Chenu, Conch., Ill., p. 7, pl. 6, fig. 2) (not *D. filum*, Dall and Simpson, Bull. U. S. Fish Comm., for 1900, vol. 1, p. 456).

The shell is very small and slender, of round section, thin, but not fragile, moderately and regularly curved, slowly and regularly increasing in diameter. In texture it is vitreous, either transparent, or merely translucent on account of being clouded by more or less opaque rings. The color is white, occasionally tinged with salmon. There is no trace of longitudinal sculpture. Many rings of growth closely crowded together upon the transparent tips are often observable under a lens. Slight irregularities of growth prevent the surface from being perfectly smooth, and therefore less polished than in many vitreous species, but a Cuban form is absolutely smooth and glistening. The apex is generally squarely cut across and from the orifice projects a very thin inner tube. There is no apical notch or slit. Measurements are:

Length, 13 mm.; diameter, 1.5 mm.; arc, 0.5 to 1.

Hatteras region, in 17 to 124 fathoms; Florida Keys region, 8 to 180 fathoms; Gulf of Mexico, 60 to 85 fathoms; Cuba, Barbados. It is probably widely distributed throughout the entire Antillean region in shallow to moderate depths.

Known in American collections as "*Dentalium filum* Sowerby," the name chosen by Doctor Dall in the *Blake* report for various lots from the Hatteras region. Sowerby's *D. filum* and *D. fistula* and Jeffrey's *D. gracile* were all described from east Atlantic localities, and their identity with our species is very questionable. Guilding's *D. sowerbyi* antidates all others, and was, moreover, described from the Caribbean. Although inadequately described, there can be no doubt it is the species under consideration.

DENTALIUM (EPISIPHON) SOWERBYI SOWERBYI Guilding.

Plate 13, figs. 2, 3, 10.

This, the typical subspecies, includes all specimens answering the general description given of *Dentalium sowerbyi*, excluding only the highly polished, perfectly smooth, and transparent form which finds its habitat in certain Cuban waters. This subspecies presents a shell of somewhat coarser surface, rendered translucent rather than transparent by reason of an uneven deposit of the shell material during growth. The shells are rather thicker and less delicate than the *D. s. pelliceri* next considered.

The measurements are the same as given for *D. sowerbyi*.

The many lots in the United States National Museum collection, as shown in the table below, are from the American continental shelf zone from Hatteras south to the Gulf of Mexico, and then from Barbados. Further research in Antillean waters will likely fill in the great gap.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
6	93106	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2592.	120 fms., 58°, fne. gy. s.
7	92831	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2601.	107 fms., 67.4°, gy. s. p.
100+	93107	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2595.	63 fms., 75°, gy. s. brk. sh.
30	329527	....do	63 fms., 75°, gy. s. brk. sh.
4	329947	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2602.	124 fms., 61°, s. r.
28	329903	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2600.	87 fms., 71.5°, fne. gy. s.
33	93109	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2602.	124 fms., 61°, s. r.
16	93108	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2596.	49 fms., 79°, gy. s.
12	93110	Off Cape Fear, North Carolina, U. S. B. F. Station 2616.	17 fms., s. p.
80+	314486	Miami, Florida, *Eolis* Station 48	60 fms., g. m.
10	314487	Miami, Florida, *Eolis* Station 51	24 fms.
4	314488	Miami, Florida, *Eolis* Station 87	63 fms.
30	314489	Miami, Florida, *Eolis* Station 69	38 fms.
1	314490	Miami, Florida, *Eolis* Station 86	58 fms.
16	314491	Miami, Florida, *Eolis* Station 115	100 fms.
4	314492	Miami, Florida, *Eolis* Station 116	65 fms.
13	314493	Miami, Florida, *Eolis* Station 113	18–20 fms.
33	314494	Miami, Florida, *Eolis* Station 82	83 fms.
1	314495	Miami, Florida, *Eolis* Station 62	20 fms.
8	314496	Miami, Florida, *Eolis* Station 49	30 fms., s. brk. c.
1	314497	Miami, Florida, *Eolis* Station 118	30 fms.
8	314498	Off Miami, Florida, *Eolis* Station 68	45 fms.
13	314499	Off Miami, Florida, *Eolis* Station 67	50 fms.
1	314500	Off Miami, Florida, *Eolis* Station 77	8 fms.
15	314501	Off Miami, Florida, *Eolis* Station 93	18–25 fms.
5	314502	Off Miami, Florida, *Eolis* Station 122	30 fms.
6	314503	Off Miami, Florida, *Eolis* Station 95	90 fms.
1	314504	Off Miami, Florida, *Eolis* Station 124	35 fms.
20	314505	Off Miami, Florida, *Eolis* Station 117	35–38 fms.
3	314506	Off Miami, Florida, *Eolis* Station 94	42 fms.
19	314507	Off Miami, Florida, *Eolis* Station 140	65 fms.
9	314508	Off Fowey Light, Florida, *Eolis* Station 177	60 fms.
50+	314509	Off Fowey Light, Florida, *Eolis* Station 364	75–90 fms.
2	314510	Off Fowey Light, Florida, *Eolis* Station 152	40 fms.
35	314511	Off Fowey Light, Florida, *Eolis* Station 142	40 fms.
5	314512	Off Fowey Light, Florida, *Eolis* Station 119	23 fms.
3	314513	Off Fowey Light, Florida, *Eolis* Station 127	42 fms.
20	314514	Off Fowey Light, Florida, *Eolis* Station 183	80 fms.
100	314515	Off Fowey Light, Florida, *Eolis* Station 351	90 fms.
100+	314516	Off Fowey Light, Florida, *Eolis* Station 352	90 fms.
2	314517	Off Fowey Light, Florida, *Eolis* Station 128	60 fms.
10	314518	Off Fowey Light, Florida, *Eolis* Station 121	30 fms.
8	314519	Off Fowey Light, Florida, *Eolis* Station 149	28 fms.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
15	314520	Off Fowey Light, Fla., *Eolis* Station 169	70 fms.
40	314521	Off Fowey Light, Fla., *Eolis* Station 356	55 fms.
10	314522	Off Fowey Light, Fla., *Eolis* Station 123	22 fms.
2	314523	Off Fowey Light, Fla., *Eolis* Station 155	43 fms.
1	314524	Off Fowey Light, Fla., *Eolis* Station 107	40-50 fms.
75	314525	Off Fowey Light, Fla., *Eolis* Station 355	70 fms.
3	314526	Off Fowey Light, Fla., *Eolis* Station 105	40 fms.
50	314527	Off Fowey Light, Fla., *Eolis* Station 353	85 fms.
9	314528	Off Fowey Light, Fla., *Eolis* Station 174	58 fms.
2	314529	Off Fowey Light, Fla., *Eolis* Station 108	38 fms.
6	314530	Off Fowey Light, Fla., *Eolis* Station 144	45 fms.
2	314531	Off Fowey Light, Fla., *Eolis* Station 151	55 fms.
8	314532	Off Fowey Light, Fla., *Eolis* Station 90	44 fms.
50+	314533	Off Fowey Light, Fla., *Eolis* Station 354	80 fms.
30	314534	Off Fowey Light, Fla., *Eolis* Station 362	95 fms.
30+	314535	Off Fowey Light, Fla., *Eolis* Station 374	85 fms.
25	314536	Off Fowey Light, Fla., *Eolis* Station 361	75-100 fms.
50+	314537	Off Fowey Light, Fla., *Eolis* Station 373	70-90 fms.
7	314538	Off Fowey Light, Fla., *Eolis* Station 363	85 fms.
33+	314539	Off Fowey Light, Fla., *Eolis* Station 375	75-90 fms.
2	314540	Off Fowey Light, Fla., *Eolis* Station 153	
8	97179	Off Cape Florida, Florida, U. S. B. F. Station 2646.	85 fms., gy. s. form.
12	151983	.....do	85 fms., gy. s. form.
5	151990	.....do	85 fms., gy. s. form.
13+	314541	Off Cape Florida, *Eolis* Station 189	67 fms.
27	314542	Off Ragged Key, Florida, *Eolis* Station 193	80 fms.
7	314543	Off Ragged Key, Florida, *Eolis* Station 192	75 fms.
50+	314544	Off Ragged Key, Florida, *Eolis* Station 366	75-90 fms.
25+	414545	Off Turtle Harbor, Florida, *Eolis* Station 58	50 fms.
3+	314546	Off Turtle Harbor, Florida, *Eolis* Station 61	40 fms.
100+	314547	Off Caeser's Creek, Florida, *Eolis* Station 376	90 fms.
2+	314548	Off Long Reef, Florida, *Eolis* Station	38 fms.
35+	314549	Off Triumph Reef, Florida, *Eolis* Station 350	70-90 fms.
50+	314550	Off Ajax Reef, Fla., *Eolis* Station 369	80-100 fms.
50+	314551	Off Ajax Reef, Florida, *Eolis* Station 370	70-90 fms.
11+	314552	Straits of Florida, U. S. B. F. Station 2639-47	50-250 fms.
7	330427	Off Carysfort Reef, U. S. B. F. Station 2641	60 fms., co. s., 69.2°.
1	314553	Off Sambo Reef, *Eolis* Station 197	75 fms.
5	314554	Off Sambo Reef, *Eolis* Station 195	50 fms.
16	314555	Off Key West, Florida, *Eolis* Station 42	60 fms.
50	314556	Off Key West, Florida, *Eolis* Station 3	63 fms.
11	314557	Off Key West, Florida, *Eolis* Station 63	78 fms.
11	314558	Off Sand Key, Florida, *Eolis* Station 300	72 fms.
2	314559	Off Sand Key, Florida, *Eolis* Station 161	76 fms.
7	314560	Off Sand Key, Florida, *Eolis* Station 16[illegible]	78 fms.
40	314561	Off Sand Key, Florida, *Eolis* Station 56	70 fms.
20	314562	Off Sand Key, Florida, *Eolis* Station 98	79-90 fms.
2	314563	Off Sand Key, Florida, *Eolis* Station 32	61 fms.
3	314564	Off Sand Key, Florida, *Eolis* Station 160	62 fms.
3	323758	Off Mobile, Ala., U. S. B. F. Station 2389	27 fms., gy. s. brk. sh.
20	151884	Between Mississippi Delta and Cedar Key, Station U. S. B. F., 2404.	60 fms., gy. s.
13	151875	.....do	60 fms., gy. s.
25	323945	.....do	60 fms., gy. s.
2	323215	Off Cape San Blas, Florida., U. S. B. F. Station 2369	26 fms., crs. gy. s. brk. sh.
21	314826	Sand Key, Florida, *Eolis* Station 100	65 fms.
34	314827	Fowey, Florida, *Eolis* Station 382	70 fms.
2	314828	Fowey, Florida, *Eolis* Station 360	100 fms.
1	314829	Pelecan Island, Barbados, S. U. I. Exp. Station 51.	33 fms.
1	314830	Barbados, S. U. I. Exp. Station 51	90 fms.
1	314831	Needham Point, Barbados, S. U. I. Exp. Station 3.	25-40 fms.
1	314836	Barbados, S. U. I. Exp. Station 72	90 fms., sand.
80	314904	Barbados. S. U. I. Exp. Station 40	90 fms.

DENTALIUM (EPISIPHON) SOWERBYI PELLICERI, new subspecies.

Plate 13, figs. 7, 8, 9.

A number of lots of *Dentalium sowerbyi* taken by the *Barrera* Expedition on the northwest coast of Cuba from littoral stations within the Colorados Reefs are of shells thinner, more transparent, and more noticeably of a salmon tint, and with a smoother polished surface than in the typical subspecies. As these live in protected waters they preserve their tips, thus appearing to be more slender. This is one of the most beautiful of the smaller *Dentalia*, and I am glad to dedicate it to the captain of the *Tomas Barrera*, Gaspar Pellicer.

The type, Cat. No. 314565, U.S.N.M., was dredged in the harbor of Bahia Honda, Cuba in 1 to 12 fathoms. It measures—length, 11.5 mm.; diameter, 0.9 mm.; tip preserved.

Another specimen from the same lot with tip lost, but with a projecting "pipe", measure—length, 14.5 mm., diameter, 0.95 mm. There are in the National Museum collection eight lots from within the Colorados Reefs, Cuba; one from off Sand Key, Florida, 65 fathoms; and one from Cape Catoche, Yucatan, in 25 fathoms.

The following are the National Museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
75	314565	Bahia Honda, Cuba, *Barrera* Station 208	1–12 fms.
85	314566	Punta Colorado, northwest Cuba, Station 207	2–3 fms.
100	314567	Cabanas Harbor, northwest Cuba, Station 203	3–12 fms.
5	314568	Cayo Arenas, northwest Cuba, Station 204	2 fms.
27	341569	Santa Rosa, northwest Cuba, Station 209	3–6 fms.
3	314570	Cape Cajon, northwest Cuba, Station 211	
2	314571	Sand bar, off Arroyos, Cuba, Station 206	
6	314572	Esperanza, Cuba, Station 210	2–3 fms.
1	314573	Cape Catouche, Yucatan, U. S. B. F. Station 2361.	25 fms.
50+	314573	Santa Lucia, northwest Cuba, *Barrera* Station 200.	2–4 fms.

Subgenus BATHOXIPHUS Pilsbry and Sharp, 1897.

1897. *Bathoxiphus* Pilsbry and Sharp, Tryon's Man. Conch., vol. 16, p. 121.

The shell is thin, conspicuously compressed laterally and nearly smooth; it has a broad apical slit on the convex side.

Lateral compression, at least when carried to a noticeable degree, is very unusual among the *Dentalia*. The subgenus contains but two well-defined species and a possible third.

KEY TO THE SPECIES OF THE SUBGENUS BATHOXIPHUS.

Keeled on both convex and concave sides	*ensiculus*, page 81.
Keeled on convex side only	*didymum*, page 83.

DENTALIUM (BATHOXIPHUS) ENSICULUS Jeffreys.

Plate 14, figs. 1, 4, 5, 7, 9.

1877. *Dentalium ensiculus* Jeffreys, Ann. and Mag. Nat. Hist., ser. 4, vol. 19, p. 154.

1881. *Dentalium sigsbeanum* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 38.

1882. *Dentalium ensiculus* Jeffreys, Proc. Zool. Soc., p. 660, pl. 49, fig. 4.

1885. *Dentalium ensiculus*, Watson, *Challenger* Report (Scaphopoda), p. 12, pl. 2, fig. 2.

1885. *Dentalium ensiculus*, Verrill, Trans. Conn. Acad. of Arts and Sci., vol. 6, p. 432.

1889. *Dentalium ensiculus*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 428, pl. 27, fig. 12.
1889. *Dentalium ensiculus*, Dall, Proc. U. S. Nat. Mus., vol. 12, p. 294.
1897. *Dentalium ensiculus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 121, pl. 7, figs. 7–10.
1903. *Dentalium ensiculus*, Dall, Bull. 37, U. S. Nat. Mus., p. 76.

The shell is fairly strongly arched, with chief curvature in its posterior third. It is slowly, regularly increasing in diameter, decidedly flattened laterally, and has a more or less sharp keel developed on both the convex and concave sides, becoming, however, less sharply angular near the anterior aperture in adult specimens. Occasionally a bluntly angulated keel appears on the flattened sides. The aperture is a flattened oval. The color is grayish white, the slightly roughened surface is of an oily appearance rather than polished; the shell is either translucent or quite opaque. No sculpture is present, but some concentric lines of growth are more or less prominent. There is a very wide square apical notch on the convex side, which is over half the diameter of the tip.

Measurements are:

Length, 30 mm.; greater diameter, 3 mm.; lesser diameter, 2 mm.; arc, 2.2 (Georges Bank).

Length, 31 mm.; greater diameter, 2 mm.; lesser diameter, 1.25 mm.; arc, 2.25 (St. Vincent).

Length, 19 mm.; greater diameter, 1.5 mm.; lesser diameter, 1 mm.; arc, 1.8 (Yucatan).

Variations are to be noted in size and in the degree of sharpness of keels. Antillean specimens are somewhat more slender. Northern specimens are usually more chalky and less compact in texture. I can not separate these American shells from the east Atlantic specimens in the Jeffreys collection.

It is a deep-water species of probably very considerable geographic range on the ocean floor. West Atlantic records in the National Museum collection are as follows:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
2	52086	Georges Banks, U. S. B. F. Station 2570	1,813 fms., 37°, glob. oz.
12	78621	Off Nantucket, U. S. B. F. Station 2714	1,825 fms., br. oz.
2	78622	Off Nantucket, U. S. B. F. Station 2715	1,753 fms., br. oz.
2	78620	Off Nantucket, U. S. B. F. Station 2713	1,859 fms., br. oz.
1	78623	Off Delaware, U. S. B. F. Station 2716	1,631 fms., br. oz. form.
1	108165	Off Fernandina, Florida, U. S. B. F. Station 2668.	294 fms., 46.3° gy. s. del. co.
1	87535	Off Cape Florida, Florida, U. S. B. F. Station 2644.	193 fms., s., 43.4° gy. s.
1	323776	Off Cape San Blas, Florida, U. S. B. F. Station 2399.	196 fms., gy. m. 51.6.
1	94293	Off Habana, Cuba (?)	1,024 fms. (Rush).
1	95347	Yucatan Strait *Blake* Station	640 fms.
16	95355	St. Vincent, West Indies, *Blake* Station 240	464 fms.
2	203108	Off St. Barts, U. S. B. F. Station 2750	496 fms., 44.4°.

DENTALIUM (BATHOXIPHUS) DIDYMUM Watson.

Plate 14, fig. 10.

1879. *Dentalium didymum* WATSON, Journ. Linn. Soc. London, vol. 14, p. 517.
1885. *Dentalium didymum* WATSON, *Challenger* Report (Scaphopoda), p. 10, pl. 1, fig. 11.
1897. *Dentalium enciculus didymum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 123, pl. 7, fig. 20.

The shell is extremely attenuated, slightly curved, and a little flattened laterally, especially toward the convex curve, giving a trigonal section rather than that of a flattened oval. It is porcellanous in texture, of a brilliant surface, and pure white in color. It is sculptureless but for "faint indications of longitudinal texture," and some very fine encircling growth lines. No apical features are noted in Watson's description.

The type measures—length, 1.08 inches; diameter, 0.6 inch (27.43 mm. by 1.52 mm.). The type was taken at *Challenger* Station 24, north of Culebra Island, in 390 fathoms, and is in the British Museum.

I have seen no authentic specimens. The diagnosis indicates a shell belonging to the group of *Dentalium ensiculus*, but hardly to be united to it even as a subspecies. A poor specimen in the National Museum collections from Cape Catoche, Yucatan, Cat. No. 314575, U.S.N.M., 25 fathoms, is possibly referable to this species; also three fragmentary specimens from Barbados, Cat. No. 314905, U.S.N.M., taken by the State University of Iowa Expedition at their station 6, in 100 fathoms; also one young specimen, Cat. No. 314906, U.S.N.M., from the State University of Iowa Expedition Station 2, Carlisle Harbor, Barbadoes, in 12 fathoms.

In these shells the apical features are indicated as a broad square notch on the convex side.

Subgenus COMPRESSIDENS Pilsbry and Sharp, 1897.

1897. *Compressidens* PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 123.

The shell is small, decidedly tapering, conspicuously compressed between the convex and concave sides; weakly sculptured, nearly smooth, with its apical orifice simple without either slit or notch.

KEY TO THE SPECIES OF THE SUBGENUS COMPRESSIDENS.

Shell strongly compressed; no constriction of caliber; moderately curved.
pressum, page 83.
Shell not strongly compressed; constriction of caliber; considerably curved.
ophiodon, page 84.

DENTALIUM (COMPRESSIDENS) PRESSUM Pilsbry and Sharp.

Plate 14, figs. 3, 6, 8.

1879. *Dentalium compressum* WATSON, Journ. Linn. Soc. London, vol. 14, p. 516 (not Orbigny, 1850).
1881. *Dentalium compressum*, DALL, Bull. Mus. Comp. Zool., vol. 9, p. 38.
1885. *Dentalium compressum* WATSON, *Challenger* Report (Scaphopoda), p. 9, pl. 1, fig. 9.

1889. *Dentalium compressum*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 426.
1889. *Dentalium compressum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1897. *Dentalium* (*Compressidens*) *pressum*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 124, pl. 7, fig. 11; pl. 22, figs. 50–52.
1903. *Dentalium compressum*, Dall, Bull. 37, U. S. Nat. Mus., p. 76.

The shell is strongly compressed or flattened on both the convex and concave sides; the lateral sides are not actually carinated but subangular. There is no contraction at the anterior aperture. It is moderately and regularly curved, rather quickly increasing in girth, thin but strong, and with an oval section. The color is white, with surface scarcely shining, the shell varying from translucent to rather opaque. Some faint longitudinal wrinkles are sometimes observable on the tip with shallow spaces between; irregular, densely crowded growth lines encircle the shell, coarsening the otherwise smooth surface. No apical notch or slit is present. Measurements are:

Length, 12 mm.; greater diameter, 2 mm.; lesser diameter, 1.75 mm. (Pilsbry).

Length, 11.25 mm.; greater diameter, 1.5 mm.; lesser diameter, 1.25 mm. (type).

Length, 17 mm.; greater diameter, 2 mm.; lesser diameter, 1.5 mm. (Tortugas).

This is an antillean continental slope species, reaching north to the Florida Keys region within the Gulf Stream. The type is from off Culebra Island, West Indies, in 390 fathoms, dredged by the *Challenger*.

The following lots are in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
6	314576	Fowey Light, Florida, *Eolis* Station 303	135 fms.
4	314577	Fowey Light, Florida, *Eolis* Station 306	100 fms.
7	330526	Off Cape Florida, U. S. B. F. Station 2644	193 fms., gy. s., 43.4°.
2	314578	Fowey Light, Florida, *Eolis* Station 349	100-150 fms.
2	314579	Fowey Light, Florida, *Eolis* Station 348	110 fms.
1	94094	Between Mississippi Delta and Cedar Keys, U. S. B. F. Station 2402.	111 fms., 97m.
6	323777	Off Cape San Blas, Cedar Keys, U. S. B. F. Station 2399.	196 fms., gy. m., 51.6°.
7	95342	South of Tortugas, *Blake* Station 43	339 fms., 45°.
1	95341	Off Cape San Antonio, Station 43	413 fms.
1	108161	Fernandina, Florida, U. S. B. F. Station 2668	94 fms., 46.3° gy. s. dd. co.

DENTALIUM (COMPRESSIDENS) OPHIODON Dall.

Plate 14, fig. 2.

1881. *Dentalium ophiodon* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 38.
1889. *Dentalium ophiodon* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 427, pl. 26, fig. 9.
1889. *Dentalium ophiodon* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 26, fig. 9.
1897. *Dentalium ophiodon*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 126, pl. 7, fig. 13; pl. 22, figs. 61, 62.

(?)1901. *Dentalium filum*, Dall and Simpson, U. S. Fish Comm. Bulletin for 1900, vol. 1, p. 456.

1903. *Dentalium ophiodon* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 26, fig. 9.

The shell is small, evenly and considerably curved, slowly tapering, markedly compressed on the convex and concave sides, but not to the extent shown in *Dentalium pressum;* the lateral edges are not angulated even bluntly; the compression is greatest just back of the anterior aperture, which often appears to be somewhat constricted. It is thin but strong, of white color, glossy but not highly polished. A sculptural feature of "faint, irregular longitudinal striations" are given by the author, but I have never been able to detect these. Growth lines more clearly seen by aid of a lens, arch forward on the concave side. The entire surface is smooth but not polished. The apical orifice is simple, having neither notch nor slit. Measurements are:

Length, 15.5 mm.; greater diameter, 1.75 mm.; lesser diameter, 1.5 mm. (Pilsbry).

Length, 12.5 mm.; greater diameter, 1.33 mm. (Dall).

Length, 14.5 mm.; greater diameter, 1.25 mm.; lesser diameter, 1 mm., arc 1.5 (type).

The type, Cat. No. 95344, U. S. N. M., obtained by the *Blake* at United States Coast Survey Station 21, off Bahia Honda, Cuba, in 287 fathoms; no further data given.

This is an Antillean species of the continental slope zone. It is readily distinguished from *Dentalium pressum* by its smaller size and lesser degree of compression. A young specimen from Mayaguez, Porto Rico, Cat. No 161576, taken in 25 fathoms, is possibly *D. ophiodon*.

The following lots are in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	95345	Off Bahia Honda, Cuba, U. S. C. S. Station 21	287 fms.
1	314580	Off Fowey Light, Florida, *Eolis* Station 305	110 fms.
1	314581	Off Fowey Light, Florida, *Eolis* Station 364	75-90 fms.
2	314582	Off Fowey Light, Florida, *Eolis* Station 361	75-100 fms.
5	314583	Off Fowey Light, Florida, *Eolis* Station 373	70-90 fms.
1	314584	Off Fowey Light, Florida, *Eolis* Station 375	75-90 fms.
3	314585	Caesar's Creek, Florida, *Eolis* Station 376	90 fms.
1	314586	Off Ragged Key, Florida, *Eolis* Station 366	75-90 fms.
1	314587	Off Western Dry Rocks, Florida, *Eolis* Station 319.	90 fms.
1	314588	Off Western Dry Rocks, Florida, *Eolis* Station 320.	80 fms.
1	314589	Off Key West, Florida, *Eolis* Station 333	110 fms.
1	314590	Off Key West, Florida, *Eolis* Station 146	98 fms.
1	323812	Off Cape San Blas, Florida, U. S. B. F. Station 2400.	169 fms., gy. m.
[1] 1	95344	Off Bahia Honda, Cuba, U. S. C. S. Station 20	220 fms.
4	95346	Off Barbados, *Hassler*	110 fms.
4	314832	Barbados, S. U. I. Station	(deep).
4	314833	Barbados, off Pelican Island, S. U. I. Station 62	125 fms.
1	314834	Off Fernandina, Florida, U. S. B. F. Station 2668.	294 fms., gy. s. dd. co., 46.3°.
1	314835	Off Lazaretto, Barbados, S. U. I. Exped. Station 38.	130-140 fms., sd.

[1] Type.

Subgenus FUSTIARIA Stoliczka, 1868.

1868. *Fustiaria* STOLICZKA, Mem. Geol. Survey of India, Cretaceous Fauna of Southern India, vol. 2, p. 439.

Shell either polished smooth and sculptureless or with encircling grooves, having a round section. The apical orifice is round or ovate and has a very long, straight linear cleft on the convex side.

The subgenus includes but few recent forms, and but one species in the faunal areas here considered. The important feature of the subgenus is the very long apical cleft. It represents the extreme of the apical characters referred to as an "apical slit."

DENTALIUM (FUSTIARIA) STENOSCHIZUM Pilsbry and Sharp.

Plate 15, figs. 8, 9.

1860. *Dentalium translucidum* SOWERBY, Thes. Conch., vol. 3, p. 98, pl. 225, fig. 47 (not of Deshayes, 1821).
1872. *Dentalium translucidem* SOWERBY, Reeve's Conch. Icon., vol. 13, pl. 6, fig. 39.
1897. *Dentalium* (*Fustiaria*) *stenoschizum* PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 129, pl. 19, figs. 10–15.
1901. *Dentalium* (*Fustiaria*) *stenoschizum*, DALL and SIMPSON, Bull. U. S. Fish Comm. for 1900, vol. 1, p. 457.

The shell is rather strongly curved, having the maximum curvature in the posterior portion; it is regularly and rapidly increasing in diameter. The section is round; the shell is thin throughout, and almost fragile at the oral aperture. It is white, with a polished, smooth shining surface, transparent at the aperture and translucent elsewhere, and is wholly sculptureless. It possesses an extremely long and narrow apical slit, which in some specimens is quite one-fourth the entire length of the shell. This long cleft is on the convex side. Measurements are:

Length, 35 mm.; diameter, 3.4 mm. (Pilsbry).

Length, 26 mm.; diameter, 2.75 mm.; arc, 1.75 (Porto Rico).

This is the only species of this group so far recorded from the western Atlantic.

The museum lots are: One specimen, Cat. No. 161577, U.S.N.M., from Mayaguez Harbor, Porto Rico, U. S. B. F.; one specimen, Cat. No. 314837, U.S.N.M., collected by the State University of Iowa Expedition at their station 88, off the Lazaretto, Barbados, in about 100 fathoms; two specimens, Cat. No. 314838, U.S.N.M., collected by the State University of Iowa Expedition at their station 10, in 100 fathoms, off Pelican Island, Barbados; one specimen, Cat. No. 314907, U.S.N.M., dredged at Eolis Station 317, off the Western Dry Rocks, Florida, in 110 fathoms.

Family SIPHONODENTALIIDAE.

(For diagnosis see p. 10.)

Genus ENTALINA Monterosato, 1872.

1872. *Entalina* MONTEROSATO, Notizie intorno alle Conchiglie Fossile di Monte Pellegrino e Ficarazzi, p. 27.

The shell, as in *Dentalium*, is largest at the aperture, tapering regularly to the apex; it is strongly ribbed with the apex either of angular or of round section. The foot of the animal expands into a disk, with digitate periphery, and has a median process or filament.

There are but two species of this genus thus far known from the western Atlantic.

KEY TO THE SPECIES OF THE GENUS ENTALINA.

Shell four sided	*quadrata*, page 88.
Shell five sided	*platamodes*, page 87.

ENTALINA PLATAMODES Watson.

Plate 15, figs. 1, 4, 5, 7.

1879. *Siphodentalium platamodes* WATSON, Journ. Linn. Soc. London, vol. 14, p. 519.

1885. *Siphodentalium platamodes* WATSON, *Challenger* report (Scaphopoda), p. 13, pl. 2, fig. 4.

1889. *Dentalium platamodes*, DALL, Bull. 37, U. S. Nat. Mus., p. 76.

1897. *Entalina platamodes*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 133, pl. 23, figs. 3–5.

1903. *Dentalium platamodes*, DALL, Bull. 37, U. S. Nat. Mus., p. 76.

The shell is small, finely tapered, strongly curved, especially near apex, five sided, but with four more prominent angles, forming roughly a square; the concave side is divided into two spaces by the fifth more obtuse angle. The extreme end of the apex is round, thin but solid. The color of the National Museum specimens is white, translucent, but the surface is not highly polished. A riblet following closely along each of the four prominent angles seemingly doubles these corner angles. A few longitudinal striae appear close to the angles, but none occupy the central portions of the flat spaces between, leaving them perfectly smooth, save for some microscopic growth lines. The concave space bisected by a primary obtuse angle referred to as less prominent than the other four tends to carry more of the longitudinal striae than do the other interangle spaces. No apical notch is present. Measurements are:

Length, 0.47 inch; diameter, 0.049 inch (type) (11.94 mm. by 1.27 mm.).

Length, 10.5 mm.; diameter, 1.25 mm.; arc, 1.75 (Rebecca Shoals).

There seems to be no question as to the identity of the National Museum specimens with Watson's species as described from off Culebra Island, West Indies, in 390 fathoms.

In the museum collection are two lots: One specimen, Cat. No. 94294, U.S.N.M., collected by Commander Rush, United States Navy, off Rebecca Shoals, Florida, in 430 fathoms, bottom of coral mud; three specimens, Cat. No. 108163, U.S.N.M., dredged by the *Albatross* at U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of sand and temperature 46.3° F.

ENTALINA QUADRATA, new species.

Plate 15, figs. 2, 3, 6, 10.

The shell is small, thin but solid, strongly curved, especially near the apex. The tip is quadrate, the entire shell preserving a quadrate section throughout; the flat surface of the convex side is the smallest, that of the concave side the largest, and the two lateral spaces are about equal. The color is hyaline white; translucent; the surface is not brightly polished. In the tip portion the four flat spaces between the angles are smooth but soon take on six to eight thread-like longitudinal secondary riblets persisting to the end, the primaries remaining always as definite corners or angles rather than ribs. No apical features are present.

The type, Cat. No. 95354, U.S.N.M., measures—length, 12 mm.; diameter, 1.1 mm.; arc, 1.75; and was dredged by the *Blake* at the United States Coast Survey Station 248 off Grenada, in 159 fathoms, bottom of fine gray ooze, temperature 53.5° F.

The difference between this and *Entalina platamodes* seems well defined in the few specimens at my command, but it is quite possible that a series of many specimens would unite the two.

Both this and *E. platamodes* are evidently species of the Antillean island slope zone and probably occupy as well a still deeper range.

Genus SIPHONODENTALIUM Sars, 1859.

1859. *Siphonodentalium* SARS, Forh. Videnskabs-Selskabet i Christiania, Aar 1858, p. 52.

The shell is arcuate, slightly tapering, the largest diameter being at the aperture; circular, or nearly so, in section; smooth, with a rather large apex, which may be either simple or slit into lobes. The foot of the animal is capable of expanding into a terminal disk.

The subgenera indicated are:

Siphonodentalium, characterized by the apex being slit into lobes or teeth; and

Pulsellum, which has a simple apex, unmodified by lobes or teeth.

The genus includes a few species of cold water distribution, which, for the most part, live upon the lower continental shelf or the ocean floor.

KEY TO THE SPECIES OF THE SUBGENUS SIPHONODENTALIUM.

Shell smooth.
  Apex 6 lobed..*lobatum*, page 89.
  Apex 2 lobed.
    Less slender shell (5.5 mm. by 1.23 mm.)..................*tytthum*, page 91.
    More slender shell (7 mm. by 0.8 mm.)....................*verrilli*, page 91.
Shell not smooth...*striatinum*, page 90.

SIPHONODENTALIUM (SIPHONODENTALIUM) LOBATUM Sowerby.

Plate 16, figs. 1, 9.

1851. *Dentalium vitreum* SARS, Ny. Mag. f. Naturviden., vol. 8, p. 178 (not of Gmelin, 1788).
1860. *Dentalium lobatum* SOWERBY, Thes. Conch., vol. 3, p. 100, pl. 3, fig. 44.
1860. *Dentalium lobatum* SOWERBY, Reeve, Conch. Icon., vol. 18, pl. 5, fig. 36.
1880. *Siphonodentalium vitreum*, VERRILL, Proc. U. S. Nat. Mus., vol. 3, p. 394.
1882. *Siphonodentalium vitreum*, VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 5, pt. 2, p. 557.
1896. *Dentalium lobatum*, CLESSIN, Conchylien Cab., vol. 6, pt. 5, p. 15, pl. 4, fig. 6.
1897. *Siphonodentalium lobatum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 136, pl. 23, figs. 8 to 21.
1901. *Siphonodentalium lobatum*, WHITEAVES, Cat. Mar. Invert. Canada, p. 153.
1915. *Siphonodentalium lobatum*, JOHNSON, Occ. Papers Boston Soc. Nat. Hist., vol. 7, No. 13, p. 83.

An extensive European bibliography is omitted.

The shell is short, thin but solid, and so rapidly increasing in diameter as to give to it a "stumpy" appearance. It is regularly, deeply curved, with a rather large apex. The anterior aperture is oblique and shell section round. The color is of a milky white, the shell being of vitreous texture, translucent, and sometimes quite transparent. The surface is smooth and sometimes highly polished. It is without sculpture. The apical characters consist of six lobes, a subtriangular one on each side, with two on the convex, and two short ones on the concave side. These apical features, however, are rarely well preserved on account of the fragile nature of the lobes.

Measurements are:

Length, 16 mm.; diameter, 2.7 mm.; arc, 1.8 (Finmark).
Length, 17 mm.; diameter, 2.5 mm.; arc, 2. Gulf of St. Lawrence.
Length, 19 mm.; diameter, 3 mm.; arc, 2. Lofoten.

This is a deep cold water species of the northern Atlantic and Arctic Oceans.

A critical comparison of American specimens with lots in the Jeffreys collection leaves no room for doubt as to their specific identity. Three lots from off Marthas Vineyard in 100 to 384 fathoms, and from off Cape Hatteras in 516 fathoms, are smaller than the dimension above given. As they are but fragments I have not separated them from the general series. It is probably a very widely distributed species on the ocean floor.

The following are west Atlantic records in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	83425	Gulf of St. Lawrence (Whiteaves)	
1	75458	Gulf of Maine, U. S. B. F. Station 12 B	60 fms., br. m., 42°.
1	38174	Off Marthas Vineyard, U. S. B. F. Station 949	100 fms., yl. m., 52°.
1	202964	Off Marthas Vineyard, U. S. B. F. Station 2213	384 fms., gr. m., 39.5°.
1	35762	Off Cape Hatteras, U. S. B. F. Station 2110	516 fms., br. m., 40°.
1	314907	Off New Jersey, U. S. B. F. Station 2210	1525 fms., gy. oz., 36.9°.
1	314908	Off Nantucket, U. S. B. F. Station 2570	1813 fms., glob. oz., 36.8°.

SIPHONODENTALIUM (SIPHONODENTALIUM?) STRIATINUM, new species.

Plate 16, fig. 3, 8.

A lot of 10 specimens, none of which are in good condition, from off Fernandina in 294 fathoms, are not referable to any known Scaphopod species. Although none of these preserve the apical features in sufficient definiteness to establish their positive reference to *Siphonodentalium,* yet the general facies of the shells seem clearly to place them within that group. An objection lies in the fact that these shells are not wholly sculptureless, but even this fact might not constitute a bar, as so few species of this genus are known. Doctor Watson included the sculptured *Siphonodentalium eboracense* under this genus, and his dictum was approved by Pilsbry and Sharp in their monograph.[1] It seems best for the present to include this species here, and should new and better material come to hand and make more positive this classification, the original description of Sars's genus can be amended to include sculptured forms. I feel quite sure this will ultimately be necessary.

The shell is moderately to strongly and irregularly curved, short, of rather quickly increasing diameter, and with a relatively large apical opening. The cylinder has not the regularity of increase usual in *Dentalium,* but in certain sections of the shell it appears to be slightly swollen. It is thin but not fragile, translucent and white in color, the surface having an oily rather than a polished appearance. About 60 very minute longitudinal striae, beginning at the apex and continuing with lesser distinctness to the senile portion of the shell, are a peculiar feature. These striae can hardly be seen without the aid of a strong lens. Any apical features, if present, are not revealed by National Museum specimens. The ragged edges of the apices may indicate a series of lobes or slits.

The type, Cat. No. 108166, U.S.N.M., measures—length, 7 mm.; diameter, 1 mm. It was dredged by the *Albatross* at U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of gray sand and dead coral, temperature 46.3° F. It is from a lot of 10 specimens.

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[1] Manual of Conchology, vol. 17, p. 140.

SIPHONODENTALIUM (SIPHONODENTALIUM) TYTTHUM Watson.

Plate 16, fig. 5.

1879. *Siphonodentalium tytthum* WATSON, Journ. Linn. Soc. London, vol. 14, p. 520.

1885. *Siphonodentalium tytthum* WATSON, *Challenger* Rept. (*Scaphopoda*) p. 14, pl. 2, fig. 5.

1897. *Siphonodentalium tytthum*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 137, pl. 23, fig. 2.

The shell is thin, very short, very rapidly broadening, and strongly curved. The color is white, glossy, but not brilliant; translucent, but opaque when dead. It is sculptureless save for faint growth lines. The apex has two lateral clefts.

The type measures—length, 5.5 mm.; diameter, 1.23 mm. It was taken north of Culebra Island in 390 fathoms by the *Challenger* at Station No. 24.

There are no examples in the museum collection, nor have I seen specimens of this species.

SIPHONODENTALIUM (SIPHONODENTALIUM), species?

A single imperfect specimen in the National Museum collection of a large species of *Siphonodentalium*, suggesting but not referable to *S. lobatum*, I leave unnamed in the hope that better material may some time be received that will furnish a positive diagnosis. It is Cat. No. 161574, U.S.N.M., from Mayaguez Harbor, Porto Rico, in 25 fathoms, taken at the U. S. B. F. Station 6062.

SIPHONODENTALIUM (SIPHONODENTALIUM) VERRILLI, new species.

Plate 16, figs. 2, 7.

A few lots of *Scaphopods* in the museum collection labeled by Professor Verrill "*S. teres* Jeffreys var.," upon careful comparison with Jeffreys's specimens of that species from the eastern Atlantic, collected by the *Porcupine*, prove to be distinct. The following is a diagnosis of the American species:

The shell is very small, thin, slender, slightly but evenly curved and somewhat laterally compressed, giving to it an oval section; the aperture is oblique. The apical diameter is very small. The color is white, translucent, becoming milky opaque in the anterior portion; the surface has an oily appearance and is not polished. It is entirely sculptureless. The apical characters consist of two projecting lateral lobes, separated by deep cuts or slits on the concave and convex sides.

The type, Cat. No. 314844, U.S.N.M., measures—length, 7 mm.; diameter, 8 mm.; arc, 2. It was dredged by the *Albatross* at the

U. S. Bureau of Fisheries Station 2710, off Nantucket, in 984 fathoms, bottom of green mud.

In the Transactions of the Connecticut Academy of Sciences (vol. 6, pt. 1, p. 218) Professor Verrill refers to *Siphonodentalium teres* Jeffreys, three lots taken by the *Albatross* at U. S. Bureau of Fisheries Station 2072 in 858 fathoms, at Station 2084 in 1,290 fathoms, and at Station 2115 in 843 fathoms. All these stations are off Nantucket. I have not seen these specimens.

The apical features of this, as well as of most of these small *Siphonodentalia*, are often obliterated by the destruction of the very fragile lobes, leaving only a ragged apical orifice, which shows only traces of one or both fissures, or perhaps leaves but a simple round opening where both lobes are evenly broken off. I have selected a specimen for the type other than that used by Professor Verrill to illustrate his "var. of *teres*," as it is a perfect specimen received since he identified the Bureau of Fisheries material.

The following table gives the lots in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	314844	Off Nantucket, U. S. B. F. Station 2710	984 fms., gr. m.
1	76833	Delaware Bay, U. S. B. F. Station 2739	811 fms., gy. m.
1	202963	Martha's Vineyard, U. S. B. F. Station 2213	384 fms., gr. m.
1	203010	Off New Jersey, U.S. B. F. Station 2710	984 fms., gr. m.
1	52304	Off Georges Bank, U. S. B. F. Station 2531	852 fms., gy. m.
3	78242	Off Nantucket, U. S. B. F. Station 2682	1004 fms., gr. m. s.
1	38076	Off Georges Bank, U. S. B. F. Station 2084	1290 fms., bu. m. s.
4	38697	Off Block Island, U. S. B. F. Station 2203	705 fms., gr. m. s.
4	78244	Off Nantucket, U. S. B. F. Station 2710	984 fms., gr. m.
1	35625	Off Hatteras, U. S. B. F. Station 2115	843 fms., m. pue. s.
1	52304	Off Georges Bank, U. S. B. F. Station 2531	852 fms., gy. m.
5	78244	Off Nantucket, U. S. B. F. Station 2710	984 fms., gr. m.

[1] Type.

The rather fragmentary character of the specimens at my disposal and the likelihood of obliteration of their apical features, if they ever possessed any, leave me doubtful as to the true subgeneric position of the two following species here placed under *Pulsellum*. It is also possible that *Siphonodentalium occidentale* and *S. verrilli* will prove to be identical when better material is at hand for critical study. *S. bushi* is clearly separable from the two just mentioned, but it may be entitled to no more than subspecific rank under any one of several northeastern Atlantic species referred to by Professor Verrill as, in his belief, conspecific with species from our side of the ocean.

Subgenus PULSELLUM Stoliczka, 1868.

1868. *Pulsellum* Stoliczka, Cret. Fauna of S. India, vol. 2, p. 441.

This subgenus includes the *Siphonodentalia* that have a simple apical orifice—that is, unmodified by lobes or slits.

Type.—*Siphonodentalium lofotense* Sars.

On account of the fragility of these apical features in small delicate shells it is often difficult to assign any species positively to this group.

KEY TO THE SPECIES OF THE SUBGENUS PULSELLUM.

Shell rather strongly curved, length 5 mm .... *bushi*, page 94.
Shell slightly curved, length 3.15 mm .... *occidentale*, page 93.

SIPHONODENTALIUM (PULSELLUM) OCCIDENTALE, new species.

Plate 16, fig. 4.

1880. *Siphoentalis lofotensis*, VERRILL, Amer. Journ. Sci., vol. 20, p. 392 (not of Sars, 1864).

1880. *Siphoentalis lofotensis*, VERRILL, Proc. U. S. Nat. Mus., vol. 3, p. 395 (not of Sars).

1882. *Siphoentalis lofotensis*, VERRILL, Trans. Conn. Acad. of Arts and Sci., vol. 5, pt. 2, p. 558 (not of Sars).

1884. *Siphoentalis lofotensis*, BUSH, Report of Com. of Fish and Fisheries for 1883, vol. 17, p. 717 (not of Sars).

1897. *Siphonodentalium* (*Pulsellum*) *lofotense*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 138, in part and omitting all figures.

1915. *Siphonodentalium* (*Pulsellum*) *lofotense*, JOHNSON, Occ. Papers Boston Soc. Nat. Hist., vol. 7, No. 13, p. 84 (not of Sars).

The shell is very small, thin, fragile, slightly curved, moderately tapering, with a relatively large apex, round section, and oblique aperture. In color it is a translucent white, with milky white bands or growth rings, and some opaque patches. It has no sculpture nor apical notch nor lobes.

The type, Cat. No. 38702, U.S.N.M., measures—length, 3.15 mm.; diameter, 0.5 mm. It was taken at the U. S. Bureau of Fisheries Station 871 off Marthas Vineyard in 86 fathoms.

Critical comparison of many of our western Atlantic species with actual types or authors' specimens of European species (hitherto considered conspecific with them), has led me to separate them at least subspecifically. I feel, therefore, that it requires substantial evidence to establish the specific, or especially a subspecific, identity of mollusks from the two sides of the Atlantic. These tiny, fragile little shells, almost featureless and usually broken and fragmentary, can not furnish this evidence. Were a larger proportion of the species of the two faunas really identical I would then consider the burden of proof to be upon the one who would separate rather than upon him who seeks to unite them. The museum records given below indicate this to be a species of the lower continental slope and of northern range:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
11	38702	Marthas Vineyard, Station 871	86 fms., lot includes type.
1	78244	New Jersey, Station 2710	984 fms., gn. m.
2	314911	Latitude 35:12:10, Station 2110	516 fms., bu. m.
2	314910	Latitude 39:09, Station 2234	810 fms., gn. m.
1	314912	Latitude 41:06, Station 2262	250 fms., gn. m. s.

SIPHONODENTALIUM (PULSELLUM) BUSHI, new species.

Plate 16, fig. 6.

1880. *Siphoentalis affinis*, VERRILL, Proc. U. S. Nat. Mus., vol. 3, p. 395. (not of Sars).

1882. *Siphoentalis affinis*, VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 5, pt. 2, p. 558, pl. 42 fig. 20 (*a*) (*b*) (not of Sars).

1884. *Siphoentalis affinis*, VERRILL, Report Com. of Fish and Fisheries for 1883, p. 573, in part.

1884. *Siphoentalis affinis*, BUSH Report Com. of Fish and Fisheries for 1883, p. 717, in part.

1897. *Siphonodentalium* (*Pulsellum*) *affine*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 140.

The shell is fairly strongly curved, regularly tapering, thin, fragile, with a large posterior aperture and round section. It is translucent, white, smooth but not shining. No sculpture is present, nor are there any apical features to be observed in museum specimens. Professor Verrill indicated "one slight notch."

The type, Cat. No. 76723, U.S.N.M., measures—length, 5mm.; diameter, 0.75 mm.; arc, 0.15. It was dredged by the *Albatross* at U. S. Bureau of Fisheries Station 2710 in 984 fathoms, bottom of green mud.

This differs from *Siphonodentalium teres* in its greater degree of curvature and the rate of increase in diameter. It is larger than *S. lofotense*, stouter than *S. affine*, and is very much larger and more curved than is *S. occidentale*.

As to the generally accepted identity of this with *S. affine* Sars, see remarks under last species (*S. occidentale*).

There are 12 lots in the museum collection, all dredged at Bureau of Fisheries stations off Marthas Vineyard, Georges Bank, Delaware, and Hatteras, in from 319 to 1,290 fathoms. It is a northern cold water species, of a depth zone ranging from the lower continental slope to the ocean floor.

The following are the museum lots:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
2	38071	Off Georges Bank, U. S. F. C. Station 2078.......	499 fms., 40°, gy. m. s.
3	61145	.....do..	Do.
2	38090	Off Marthas Vineyard, U. S. F. C. Station 894 ...	365 fms., 40°, sft. br. m.
1	52307	Off Marthas Vineyard, U. S. F. C. Station 2574 ..	390 fms., 40°, gr. m.
1	52313	Off Marthas Vineyard, U. S. F. C. Station 2584 ..	541 fms., 40°, gy. m.
2	38700	Off Marthas Vineyard, U. S. F. C. Station 2213 ..	384 fms., 39.5°, gr. m.
1	76722	Off Marthas Vineyard, U. S. F. C. Station 947 ...	319 fms., 44°, s. m.
2	38699	Off Nantucket Shoals, U. S. F. C. Station 2203 ..	705 fms., 38.9°, gr. m. s.
1	78395	Off Block Island, U. S. F. C. Station 2689........	525 fms., gr. m.
1	76662	Off Delaware, U. S. F. C. Station 2233...........	630 fms., 29.2°, gr. m.
5	76723	Off New Jersey, U. S. F. C. Station 2710.........	984 fms., gr. m. (type lot).
2	35718	Off Cape Hatteras, U. S. F. C. Station 2110......	516 fms., 40°, br. m.

Genus CADULUS Philippi, 1844.

1844. *Cadulus* PHILIPPI, Enum. Moll. Sicil., vol. 2, p. 209.

Small, white, sculptureless *Scaphopods*, which are more or less arcuate, generally swollen, or with an inflated bulging area in the middle portion of the shell or near the anterior aperture; the aperture is more or less contracted and usually very oblique. The apical aperture is proportionately quite large as compared with that of *Dentalium;* it is either simple or cut by two or four slits. Section round or flattened. Occasionally an internal circular rib is developed just within the apical orifice.

The genus is somewhat artificially divided into four subgenera as follows:

1. Apex with 2 deep slits	*Dischides.*
2. Apex with 4 deep slits	*Polyschides*, page 96.
3. Apex with 2 or 4 very shallow, broad slits	*Platyschides*, page 104.
4. Apex simple (unslit).	
(*a*) Obese, dorsal, and ventral arcs both convex	*Cadulus*, page 141.
(*b*) Slender, one arc convex, the other more or less concave	*Gadila*, page 130.

Species showing extreme characters are clearly and easily referred to a subgenus, but there are species that could be placed in more than one. The apical features, when normally present, are not infrequently broken or worn away in poor or senile specimens.

The genus is represented in east American Atlantic waters in all its faunal areas and in all depths from near the tidal zone to the abyssal depths. The mollusk lives in sandy and muddy stations and often in great individual quantity.

As a rule the species are not very widely distributed, but certain exceptions are notable. *Cadulus platensis*, for instance, is found off the Argentine coast to Georgia, and is further extended through slight shell differences into the eastern Atlantic, north to Great Britain, where, with relatively slight modification, it is *C. tumidosus* Jeffreys. This is judging only from the shell characters.

The amount of variation in any one species is usually slight, except in the bulbous species under the subgenus *Cadulus*. Among some of these the degree of swelling may differ somewhat in individuals, but even here the seemingly great variation is exaggerated to the eye by breakage of the ends of the shells causing the shortened specimens to appear more inflated. At present almost nothing is known of the ecology of the genus.

In the descriptions following, color, sculpture, and all features relating to the shell texture will be omitted, as these remain essentially the same; i. e., color white; sculpture none; texture vitreous and more or less translucent or transparent. In some cases the clear vitreous shell is modified by circular deposits of shelly material, causing alternate rings of more or less translucency. These are not, however, specific characters, but appear to be wholly individual and possibly pathologic. Sculpture is sometimes mentioned by authors, but almost apologetically. In a few cases, notably in *Cadulus acus*, the alternate rings of more and less dense shelly deposit present a surface that might possibly be referred to as sculptured, but it is not a true sculpture in the sense employed in descriptions of *Dentalium.*

The words ''dorsal'' and ''ventral'' are employed in descriptions of *Cadulus* to mean the convex and the concave sides or arc of the shell, dorsal being the convex side. There is, however, a difference of opinion as to which side is actually dorsal or truly ventral as in conformity with the ''back'' or ''front'' of the animal.

Measurements of the "arc," as the term is used in the descriptions of *Dentalium,* will be omitted, as the small size of the shell and irregular lines of curvature do not lend themselves well to this feature of diagnosis. The important specific characters of the *Caduli* are the slits and lobes about the edge of the apical orifice, referred to as "apical characters," the general shape of the shell as determined by the position of the equator (section of maximum diameter); the ratio of length to breadth; the localized or general type of swelling; the compression (either lateral or dorso-ventral) of the shell; the obliquity of the aperture; and, lastly, the size. Thus these little colorless shells possess more characters than at first seem possible. A good way to proceed in identifying material is to examine first the apical characters in order to place the shells in their proper subgeneric groups. Then seek among the figured species of about a similar size for those that have median or submedian equators or with equators more anteriorly placed. These are the important points of resemblance to be first established, after which the oval or round section, the small or large apical orifice, and the obliquity of the aperture, follow. Geographic and temperature ranges are especially important and should be kept always in mind when seeking to determine material. In a general way it may be said that the large and medium sized species fall under *Platyschides,* the small and slender forms under *Gadila,* the small bulbous species under *Cadulus,* while those of very prominent deep apical slits are *Polyschides.*

Subgenus POLYSCHIDES Pilsbry and Sharp, 1898.

1898. *Polyschides* PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 148.

The shell is inflated above [anterior to], the middle or not much bulging; the apex is cut into a number of lobes, generally four, by as many slits.

Genotype.—*Cadulus tetraschistus* Watson. For enlarged drawing of apical characters of *Polyschides* see plate 17, figure 7.

The chief characters of the subgenus are the deep slits and prominent apical lobes. In all the species coming within our notice these apical lobes are four in number.

KEY TO THE SPECIES OF THE SUBGENUS POLYSCHIDES.

- Apical notches deep.
  - Shell fusiform, length 5 to 6 mm.............................*tetrodon*, page 101.
  - Shell not fusiform.
    - Length, 7.45 mm.....................................*tetraschistus*, page 97.
    - Length, 8 to 11 mm..................*quadridentatus quadridentatus*, page 99.
  - Shell slightly compressed; length, 5 to 6 mm..*quadridentatus acompsus*, page 100.
- Apical notches less deep; length, 9 to 10 mm..................*carolinensis*, page 102.

CADULUS (POLYSCHIDES) TETRACHISTUS Watson.

Plate 17, fig. 1.

1879. *Siphodentalium tetraschistum* Watson, Journ. Linn. Soc. London, vol. 14, p. 521.
1885. *Siphodentalium tetraschistum* Watson, *Challenger* Report (Scaphopoda), p. 15, pl. 2, fig. 8.
1898. *Cadulus* (*Polyschides*) *tetraschistus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 148, pl. 23, fig. 1.

The shell is cylindric, rather evenly curved, convex on the dorsal, and concave on the ventral side, tapering from about the middle to the apex, and slightly contracted about the aperture. There is no very decided localized inflation. There is a remote suggestion of evanescent longitudinal sculpture.

The apex is slit into four pointed lobes by four unequal, irregular, rough-edged, gaping clefts, leaving the lobes one dorsal, one ventral, and two lateral. Two narrow callus-like internal bands are present just within the apex. Measurements are: Length, 7.45 mm.; diameter, 0.9 mm.; anterior aperture, 0.75 mm.; spiral aperture, 0.5 mm.

The type, now in the British Museum, was taken by the *Challenger* near the island of Fernando Noronha in 25 fathoms. The species is only known to me by original description, and there are no examples in the National Museum collection.

CADULUS (POLYSCHIDES) QUADRIDENTATUS Dall.

1881. *Siphonodentalium quadridentatum* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 36.
1885. *Cadulus incisus* Bush, Trans. Conn. Acad. Arts and Sci., vol. 6, p. 471, pl. 45, fig. 20.
1889. *Cadulus quadridentatus* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 428, pl. 27, fig. 5.
1889. *Cadulus quadridentatus* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 5.
1889. *Cadulus quadridentatus*, var. *incisus*, Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 41, fig. 20.
1889. *Cadulus quadridentatus* Dall, Proc. U. S. Nat. Mus., vol. 12, p. 295.
1892. *Cadulus quadridentatus* Dall, Trans. Wagner Free Inst. Phila., vol. 3, p. 445.
1898. *Cadulus* (*Polyschides*) *tetraschistus quadridentatus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 149, pl. 23, fig. 7; pl. 28, figs. 1–5.

1898. *Cadulus* (*Polyschides*) *tetraschistus incisus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 150, pl. 25, fig. 65.

1903. *Cadulus quadridentatus* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 5.

1903. *Cadulus incisus*, Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 41, fig. 20.

The shell is gradually and regularly increasing in diameter without any local bulge or swelling to a section just back of the aperture, thence it slightly contracts; moderately curved. A section of the shell is nearly a circle. The aperture is very oblique, oval, with its peristome rounded and smooth. The apex is cut by four deep slits, leaving four pointed lobes; the longest on the convex side is often a little bent in; the other three lobes are one on the ventral and two on the lateral sides; the lateral ones are of subequal length; the ventral lobe is wide and obtusely pointed. The edges of all these triangular lobes are flattened as though planed off.

Length, 10 mm.; greater diameter, 1.03 mm.; anterior aperture, 0.8 mm.; apical aperture, 0.4 mm. (type).

Length, 8 mm.; greater diameter, 1.1 mm.; anterior aperture, 1 mm.; apical aperture, 0.5 mm. (type of *C. incisus*).

Length, 7 mm.; greater diameter, 1 mm.; anterior aperture, 0.8 mm.; apical aperture, 0.5 mm. (*C. incisus*).

Length, 8 mm.; maximum diameter, 1.10 mm.; anterior aperture, 1 mm.; apical aperture, 0.6 mm. (average).

Length, 5.1 mm.; maximum diameter, 0.75 mm.; anterior aperture, .6 mm.; apex, .4 mm. (*C. q. acompsus*).

The type of *Cadulus quadridentatus* is in the Museum of Comparative Zoology (Cat. No. 7739) and is from the west coast of Florida, in 30 fathoms, collected by Pourtales.

The type of *C. incisus*, Cat. No. 44860, U.S.N.M., was dredged at the U. S. Bureau of Fisheries Station 2272, off Cape Hatteras, in 15 fathoms, bottom of gray sand.

The differences to be noted in Miss Bush's description of *C. incisus* from that of Doctor Dall's *C. quadridentatus* are at once harmonized by the comparison of many specimens. It is a very abundant shallow-water form from Cape Hatteras to the Gulf of Mexico, the Bahamas, Cuba, Yucatan, and probably throughout the entire Caribbean region. It is also recorded from Bermuda. Two poor specimens from off Rio de la Plata in 10 fathoms (*Albatross* Station 2765) seem to be referable to this species. The deepest record in the Museum collection is 52 fathoms off Cape Lookout, the least, 3 fathoms off Miami, Florida, and off Cat Cay, Bimini Islands.

Pilsbry and Sharp united this species with Watson's *C. tetraschistus* as Doctor Dall had already suggested in his original description. The ruling is probably correct, but lacking opportunity actually to compare specimens I hesitate to unite shallow-water forms separated by so wide an expanse of deep sea. It is, however, a species of exceptionally extended range. In many old or worn specimens the apical features become less prominent, and consequently the slits are less deep. Even in such event the shells, by reason of other characters, need never be confused with other species of normally lesser apical lobes and which occupy in part the same faunal areas.

A small race of 5.5 to 6 mm. in length, but differing in no other respect, is found in Barbados (12 fathoms). It scarcely deserves a subspecific name.

I have divided the species into two subspecies.

CADULUS (POLYSCHIDES) QUADRIDENTATUS QUADRIDENTATUS Dall.

Plate 17, figs. 2, 3.

This, the typical subspecies, includes all forms under the description of *Cadulus quadridentatus* Dall, excluding only a smaller race that exhibits a slight lateral compression in the anterior portion of the shell.

The type is of *C. quadridentatus*.

The following are the lots in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	44860	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2272.	15 fms. gy. s. blk. sp. (type of *incisus Bush*).
1	190649	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2275.	16 fathoms, gy. s. and brk. sh.
5	181243	Off Cape Hatteras, North Carolina, U. S. B. F.	17.5 fms.
22	92832	Off Cape Hatteras, North Carolina, U. S. B. F. Station 1597.	22 fms., 73.5°, wh. s., brk. sh.
3	329740	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2598.	Do.
14	93138	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2597.	15fms., crs. gy. s.
4	330174	Off Cape Lookout, North Carolina, U. S. B. F. Station 2612.	52 fms., crs. wh. s., brk. sh., 67°.
6	93142	Off Cape Lookout, North Carolina, U. S. B. F. Station 2612.	Do
1	93141	Off Cape Lookout, North Carolina, U. S. B. F. Station 2610.	22 fms., 78.8° wh. s., brk. sh.
8	93139	Off Cape Lookout, North Carolina, U. S. B. F. Station 2607.	18 fms., 73.5° fne. gy. s.
3	93140	Off Cape Lookout, North Carolina, U. S. B. F. Station 2608.	22 fms., 78.2° crs. gy. s.
13	92820	Off Cape Lookout, North Carolina, U. S. B. F. Station 2611.	31 fms., 74° blk. s., brk. sh.
37	92826	Off Cape Fear, North Carolina, U. S. B. F. Station 2617.	14 fms., crs. yl. s., brk. sh.
75+	93145	Off Cape Fear, North Carolina, U. S. B. F. Station 2619.	15 fms., crs. yl. s.
9	93143	Off Cape Fear, North Carolina, U. S. B. F. Station 2616.	17 fms., s.
10	92827	Off Cape Fear, North Carolina, U. S. B. F. Station 2622.	15 fms., 74° gy. s., brk. co.
2	82994	Frying Pan Shoals, North Carolina	12 fms. (Rush).
2	314591	Miami, Florida, *Eolis* Station 83	3 fms.
1	314592	Miami, Florida, *Eolis* Station 157	22 fms.
14	314593	Miami, Florida, *Eolis* Station 62	20 fms.
2	314594	Miami, Florida, *Eolis* Station 93	18–25 fms.
4	314595	Miami, Florida, *Eolis* Station 117	35–38 fms.
1	314596	Miami, Florida, *Eolis* Station 111	15 fms.
7	314597	Miami, Florida, *Eolis* Station 49	30 fms., s., brk. co.
2	314598	Miami, Florida, *Eolis* Station 70	10 fms.
4	314599	Miami, Florida, *Eolis* Station 51	24 fms.
4	314600	Miami, Florida, *Eolis* Station 103	20 fms.
8	314601	Miami, Florida, *Eolis* Station 118	30 fms.
8	314602	Miami, Florida, *Eolis* Station 113	18–20 fms.
15	314603	Fowey, Florida, *Eolis* Station 8	25 fms.
9	314604	Fowey, Florida, *Eolis* Station 90	44 fms.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	314605	Fowey, Florida, *Eolis* Station 107	40-50 fms.
5	314606	Fowey, Florida, *Eolis* Station 105	40 fms.
1	314607	Fowey, Florida, *Eolis* Station 119	23 fms.
1	314608	Fowey, Florida, *Eolis* Station 121	30 fms.
1	314609	Fowey, Florida, *Eolis* Station 131	25 fms.
4	314610	Off Turtle Harbor, Florida, *Eolis* Station 59	20 fms.
2	314611	Off Long Reef, Florida, *Eolis* Station 135	38 fms.
1	314612	Off Conch Reef, Florida, *Eolis* Station 7	35 fms.
1	323017	Off Key West, Florida, U. S. B. F. Station 2315.	37 fms., co.
3	314613	Tortugas, Florida, *Eolis* Station 33	16 fms.
8	323516	Off Cape San Blas, Florida, U. S. B. F. Station 2371.	26 fms., gy. s., sh., 65.8°.
1	323473	Off Cape San Blas, Florida, U. S. B. F. Station 2370.	25 fms., crs. gy. s., sh.
8	194636	Off Anclote Light, Florida, U. S. B. F. Station 7106.	12.5 fms., r., crs. s., 63°.
6	194903	West coast, Florida	10-12 fms. (Benedict).
4	181209	Point Pinallis, Florida	(Stearns.)
2	323117	Off Cape Catoche, Yucatan, U. S. B. F. Station 2361.	25 fms., crs. s.
1	314614	Cayo Levisa, Northwest Cuba, *Barrera* Station 201.	
8	314615	Cabanas Harbor, Cuba, *Barrera* Station 202	25 fms.
2	314616	South of Cat Cay, Bahamas, *Eolis* station 47	3 fms.
1	314617	South Bimini Island, Bahamas, *Eolis* Station 72.	Shore drift.
10	314618	North Bimini Island, Bahamas, *Eolis* Station 50.	20 fms.
2	96537	Off Rio La Plata, U. S. B. F. Station 2765	10 fms., s. and sh.
2	314913	Antigua, English Harbor, S. U. I. Exped	2 fms.
1	314914	Falmouth, Antigua, S. U. I. Exped	
3	314915	Carlisle Bay, Barbados, S. U. I. Exped	6 fms.
4	314916	Barbados, S. U. I. Exped	Shallow.
3	314917	Carlisle Bay, Barbados, S. U. I. Exped	12 fms., small race.
8	314918	Barbados, S. U. I. Exped	Shallow, small race.

CADULUS (POLYSCHIDES) QUADRIDENTATUS ACOMPSUS, new subspecies.

Plate 17, fig. 4.

Several lots of shallow water Caduli from Puerto Barios, Livingston, and Monkey River, Honduras, and from Belize Harbor, collected by Schumo and now in the collection of the Philadelphia Academy of Natural Sciences, are much smaller than are the shells of the typical subspecies and possess besides a slight degree of lateral compression in the extreme anterior portion of the shell. Most of the specimens in these lots are banded by irregular rings of internal callous, but this is not likely a diagnostic character.

The type measures—length, 5.1 mm.; diameter, 75 mm.; anterior aperture, 0.6 mm.; apical aperture, 0.4 mm. It is in the collection of the Philadelphia Academy of Natural Sciences, Cat. No. 76557, from Monkey River, British Honduras.

The apical features are quite normal, though broken in most of the examples before me. Some specimens are a trifle larger than the type. This must not be confused with a small race of *Cadulus quadridentatus quadridentatus*, already mentioned, from Barbados.

It is a shallow-water form of the muddy bogs and probably ranges along the entire Central American Altantic coast, but has not so far been noted from the Antilles or the Florida region. In the museum collection is one lot of five specimens, Cat. No. 314939, U.S.N.M., collected by Schumo at Monkey River, British Honduras, and presented by the Philadelphia Academy of Natural Sciences. These are from the type lot.

CADULUS (POLYSCHIDES) TETRODON Pilsbry and Sharp.

Plate 17, fig. 5.

1889. *Cadulus amiantus* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 43, in part and omitting figures.

1897. *Cadulus* (*Polyschides*) *tetrodon* Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 151, pl. 29, figs. 14–18.

The shell is small, slender and slightly curved; the convex side is rather evenly arched; the concave side is straighter, with a slight convexity at a point about one-third the total distance from the aperture—the section of maximum caliber. This amounts to but a slight swelling, from which the shell tapers gradually to the two ends. The aperture is oblique, round and its peristome blunt and rounded. The apex is cut by four slits, leaving four triangular lobes, the one on the convex side being slightly longer and rounded, the lobe opposite it broader and flat-topped, while the two lateral lobes are smaller. The edges of all these lobes are planed off or "beveled to an edge." Measurements are:

Length, 5.6 mm.; maximum diameter, 1 mm.; aperture, 0.6 mm.; apex, 0.35 to 0.43 mm.

Length, 5 mm.; maximum diameter, 0.88 mm.; aperture, 0.6 mm.; apex, 0.4 mm.

The type is in the Philadelphia Academy of Sciences collection, Cat. No. 71070, collected off Cape Florida, in 85 fathoms, by Commander Rush. Topotypes, Cat. No. 84953, U.S.N.M., were given the museum by Commander Rush.

In some of the specimens an internal opaque callous ring is observable near the apex. This is a smaller and more fusiform species than *Cadulus quadridentatus quadridentatus*, but stouter than *C. q. acompsus*. Doctor Dall's *C. amiantus* belongs to another group.

The following are the museum records.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
10	84953	Five miles off Cape Florida	85 fms. (Doctor Rush).
1	314619	Frying Pan Shoals, N. C	12¼ fms. (John Ford, collector).
1	314620	do.	12½ fms. (C. W. Johnson).
1	180428	North side of Abaco, Bahamas	Owen Bryant.
1	314621	South Cat Cay, Bahamas, *Eolis* Station 47	3 fms.
32	314622	North Bimini Island, Bahamas, *Eolis* Station 50	20 fms.
1	314623	Southeast of Fowey Light, Florida, *Eolis* Station 108.	38 fms.
1	314624	One mile southeast of Fowey Light, Florida, *Eolis* Station 8.	25 fms.
2	314625	Caesars Creek Bank, Florida, *Eolis* Station 40	1¾ fms.

CADULUS (POLYSCHIDES) CAROLINENSIS Bush.

Plate 17, figs. 6, 7.

1885. *Cadulus carolinensis* Bush, Verrill's Article in Report of Com. of Fish and Fisheries for 1883, p. 587.
1885. *Cadulus carolinensis* Bush, Trans. Conn. Acad. Arts and Sci., vol. 6, pt. 2, p. 471, pl. 45, fig. 19.
1889. *Cadulus carolinensis*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 430 (excluding Old Providence record).
1889. *Cadulus carolinensis*, Dall, Bull. 37, U. S. Nat. Mus., p. 78, in part, pl. 41, fig. 19.
1898. *Cadulus* (*Polyschides*) *carolinensis*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 152, pl. 25, fig. 64; pl. 30, figs. 24–27.
1903. *Cadulus carolinensis*, Dall, Bull. 37, U. S. Nat. Mus., p. 78, in part, pl. 41, fig. 19.

The shell is of medium size, moderately curved, with its greatest diameter about one-fourth distance from the anterior aperture. There is no bulbous or local swelling. The convex side shows a fairly even arc, but flattened and accelerated from the point of maximum diameter to the anterior aperture, which is very oblique, and with a smooth rounded peristome. The concave side shows an even, gentle curvature through its posterior half, and thence it is rather straight, showing scarcely any convexity in its outline at the point of greatest diameter. The apical opening is very small and is modified by four shallow slits or notches, producing between them four short flat-topped lobes, one dorsal, one ventral, and two lateral. These apical features are often confused by the breaking, wearing down, or by some injury to the lobes. The slits are shallower than those in the other species already referred to under *Polyschides*, and show an intermediate stage between *Polyschides* and *Platyschides*. Measurements are:

Length, 9.8 mm.; maximum diameter, 1.6 mm.; anterior aperture, 1 mm.; apical aperture, .52 by .6 mm. (type).

Length, 9.7 mm.; maximim diameter, 1.45 mm.; anterior aperture, 1 mm.; apical aperture, 0.5 mm. (Pilsbry).

Length, 9.5 mm.; maximum diameter, 2 mm.; anterior aperture, 1 mm.; apical aperture, 0.4 mm. (Bush).

The type, Cat. No. 35811, U.S.N.M., was dredged at the U. S. B. F. station 2114 off Hatteras, in 14 fathoms, bottom of mud and broken shells, temperature 72° F.

This is a very abundant species about the Hatteras region in shallow water. Records show extremes of 3 fathoms in Cape Lookout Bight to 87 fathoms off Cape Hatteras. It is less abundant farther south.

The shell is easily to be distinguished from *Cadulus quadridentatus* by its greater inflation and its shallower apical slits, and from *C. tetrodon* by its larger size. There are among the many National

Museum lots shells of smaller size than that of the type, but the smallest of these are considerably larger than *C. tetrodon*.

The following are the museum records.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	35811	Off Hatteras, North Carolina, U. S. F. C. Station 2114.	14 fms., 72°, m. blk. s. (figured).
38	35811	.....do.....................................	Do.
81	93124	Off Hatteras, North Carolina, U. S. F. C. Station 2595.	63 fms., 75°, gy. s. brk. sh.
127	93125	Off Hatteras, North Carolina, U. S. F. C. Station 2596.	49 fms., 75°, gy. s.
3	45195	Off Hatteras, North Carolina, U. S. F. C. Station 2272.	15 fms., gy. s. brk. sh.
11	93131	Off Hatteras, North Carolina, U. S. F. C. Station 2276.	16 fms., s. sh.
61	35840	Off Hatteras, North Carolina, U. S. F. C. Station 2112.	16 fms., 73°, s. blk. sh.
3	40586	Off Hatteras, North Carolina, U. S. F. C. Station 2274.	16 fms., gy. s. brk. sh.
23	314626	Off Hatteras, North Carolina, U. S. F. C. Station 2283.	14 fms., gy. s.
93	40567	Off Hatteras, North Carolina, U. S. F. C. Station 2276.	16 fms., gy. s. brk. sh.
81	41625	Off Hatteras, North Carolina, U. S. F. C. Station 2278.	Do.
33	153664	Off Hatteras, North Carolina, U. S. F. C. Station 2277.	Do.
13	44450	Off Hatteras, North Carolina, U. S. F. C. Station 2280.	Do.
27	41443	Off Hatteras, North Carolina, U. S. F. C. Station 2292.	17 fms., gy. s. brk. sh.
6	44449	Off Hatteras, North Carolina, U. S. F. C. Station 2269.	48 fms., 77° (fragments), gy. s.
27	153666	Off Hatteras, North Carolina, U. S. F. C. Station 2113.	15 fms., 72°, m. blk. s.
1	153662	Off Hatteras, North Carolina, U. S. F. C. Station 2295.	22 fms. (fragments), crs. gy. s.
36	153665	Off Hatteras, North Carolina, U. S. F. C. Station 2276.	16 fms., gy. s. brk. sh.
77	40827	Off Hatteras, North Carolina, U. S. F. C. Station 2277.	Do.
31	153663	Off Hatteras, North Carolina, U. S. F. C. Station 2112.	16 fms., 73° (fragments), s. brk. sh.
38	45196	Off Hatteras, North Carolina, U. S. F. C. Station 2273.	17 fms., 72°, gy. s. brk. sh.
1	40803	Off Hatteras, North Carolina, U. S. F. C. Station 2290.	9 fms., s. brk. sh.
23	93132	Off Hatteras, North Carolina, U. S. F. C. Station 2597.	15 fms., crs. gy. s.
53	45197	Off Hatteras, North Carolina, U. S. F. C. Station 2275.	16 fms., gy. s. brk. sh.
9	45198	Off Hatteras, North Carolina, U. S. F. C. Station 2291.	15 fms., gy. s. brk. sh.
51	35366	Off Hatteras, North Carolina, U. S. F. C. Station 2113.	15 fms., 72°, m. brk. sh.
1	40892	Off Hatteras, North Carolina, U. S. F. C. Station 2289.	7 fms., crs. s. bk. sh.
81	250179	Off Hatteras, North Carolina, U. S. F. C. Station 2601.	107 fms., gy. s. 71.5°.
8	322683	Off Hatteras, North Carolina, U. S. F. C. Station 2275.	16 fms., gy. s. brk. sh.
1	322476	Off Hatteras, North Carolina, U. S. F. C. Station 2112.	15 fms., 73.5°, sh. bk. sh.
10	322721	Off Hatteras, North Carolina, U. S. F. C. Station 2277.	16 fms., gy. s. brk. sh.
52	198162	Off Hatteras, North Carolina, U. S. F. C. Station	16 fms.
39	329528	Off Hatteras, North Carolina, U. S. F. C. Station 2595.	63 fms., gy. s. 75°, brk. sh.
1	322852	Off Hatteras, North Carolina, U. S. F. C. Station 2296.	27 fms., crs. yl. s.
111	94247	Off Cape Lookout, North Carolina, U. S. F. C. Station 2610.	22 fms., wh. s. 78.8°.
5	92830	Off Cape Lookout, North Carolina, U. S. F. C. Station 2611.	31 fms., s. 74°, brk. sh.
6	93133	Off Cape Lookout, North Carolina, U. S. F. C. Station 2607.	18 fms., s. 73.5°, fm. gy. s.
108	92829	Off Cape Lookout, North Carolina, U. S. F. C. Station 2608.	22 fms., 78.2°, crs. gy. s.
	329355	.....do.....................................	Do.
	93140	.....do.....................................	Do.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
2	93136	Off Cape Lookout, North Carolina, U. S. F. C. Station 2612.	52 fms., 67°, crs. wh. s.
1	330174	.....do.....................................	Do.
128	314627	Off Beaufort, North Carolina, *Eolis* Station 21..	6-9 fms.
1	314628	Cape Lookout, Bight, North Carolina, *Eolis* Station 20.	3 fms.
1	93137	Cape Fear, North Carolina, U. S. F. C. Station 2619.	15 fms., crs. yl. s. rot. co.
3	314629	Frying Pan Shoals, North Carolina (John Ford, collector).	12½ fms.
1	314630	Off Miami, Florida, *Eolis* Station 69............	38 fms.
1	314630	.....do.....................................	Do.
1	314631	Miami, Florida, *Eolis* Station 52................	
1	314632	Off Turtle Harbor, Florida, *Eolis* Station 58.....	50 fms.
1	314633	Off Key West, Florida, *Eolis* Station 42.........	60 fms.
1	314634	Tortugas (southwest channel), Florida, *Eolis* Station 36.	10 fms.
2	314635	Tortugas (southwest channel), Florida, *Eolis* Station 33.	16 fms.
6	323757	Off Mobile Bay, Alabama, U. S. B. F. Station 2389.	27 fms., gy. s. brk.
14	323217	Cape San Blas, Florida (Gulf), U. S. B. F. Station 2369.	26 fms., crs. gy. s. sh.
1	314637	West coast, Florida..............................	30 fms.

PLATYSCHIDES, new subgenus.

The shell has two or four apical slits, which are broad and shallow, causing the resulting lobes between them to be low and wide. The type of the subgenus is *Cadulus grandis* Verrill. For enlarged drawing of apical characters of Platyschides, see plate 18, figure 13.

This group differs from *Polyschides* in the greatly reduced prominence of the apical features. The slits often amount to no more than what would appear to be chipped-out portions of the margin of the apical orifice and having between them small, sometimes pointed but always inconspicuous lobes, or these apical slits may be only very small notches. In a few species of this subgenus the apical features become so reduced it is difficult or even impossible to refer them with certainly to it. Unfortunately, injuries to the delicate apical rim often confuse the characters or obliterate them entirely, but perfect specimens of this group usually show clearly enough their characters. *Platyschides* occupies a middle ground between *Polyschides* and *Gadila*, the latter group having no modification of the simple circular rim of the apical orifice. I can not claim for *Platyschides* any great value as a biologic subdivision, but merely as a convenient means of grouping a number of species under a fairly constant character.

All attempts at making satisfactory or even useful keys to the species have been abandoned as confusing rather than helpful. Even grouping them under their finer specific characters does not seem to be very successful.

The following five species may be placed side by side by reason only of their very large size: *Cadulus grandis*, *C. elephas*, *C. spectabilis*, *C. poculum*, and *C. aequalis*.

CADULUS (PLATYSCHIDES) GRANDIS Verrill.

Plate 17, fig. 12.

1884. *Cadulus grandis* VERRILL, Trans. Conn. Acad. of Arts and Sci., vol. 6, pt. 1, p. 219, vol. 6, pt. 2, pl. 44, fig. 20.

1898. *Cadulus* (*Polyschides*) *grandis*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 16, p. 154, pl. 25, fig. 66.

The shell is large, solid, senile specimens becoming thick and heavy, moderately curved, the curvature mostly in the posterior portion. The convex arc is quite regular to a point about one-third distance from the anterior aperture, thence to the anterior end the arc is more accelerated. The concave arc is greatest posteriorly, the last half of it being almost straight, and shows a very slight convexity at the anterior third or fourth section, that being the point of maximum caliber. The posterior aperture is large, giving the shell a "stumpy" appearance, even though the swelling at the anterior third or fourth is not very great. The anterior aperture is broadly elliptical and oblique and has its margin rounded in fully adult specimens. There are four apical slits, which are rounded and shallow, as compared with those in *Cadulus quadridentatus*, and leave broad flat lobes, the widest of which is on the convex side. The edge of this lobe is distinctly serrated, but all apical characters are usually more or less obliterated by accidental breaks. The lobes are also somewhat thickened within. Measurements are:

Length, 15 mm.; maximum diameter, 3.5 mm.; anterior aperture, 3 by 2.5 mm.; apical aperture, 1.3 mm. (type).

Length, 14 mm.; maximum diameter, 3 mm.; anterior aperture, 2.3 by 2 mm.; apical aperture, 1.2 mm. (U. S. B. F. Station 2217).

The type, Cat. No. 34735, U.S.N.M., was taken at U. S. B. F. Station 2076, off Martha's Vineyard, in 906 fathoms, bottom of blue mud.

This is a deep-water species from off Georges Bank to Hatteras in 843 to 1,467 fathoms, and was dredged by the *Albatross* at numerous stations, as shown by the appended table of lots in the museum collection.

This is one of the largest of the species of *Cadulus*. Some senile specimens exhibit a chalky texture beneath a glazed surface—a feature already noted in several of the abyssal *Dentalia* of the north Atlantic. It is easily recognized by its large size and "stumpy" form.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	34735	Off Martha's Vineyard, U. S. B. F. Station 2076.	906 fms., bu. m.
2	34735	Off Georges Bank, U. S. B. F. Station 2076	Do.
1	50333	Off Georges Bank, U. S. B. F. Station 2530	956 fms., gy. oz.
3	35184	Off Georges Bank, U. S. B. F. Station 2084	1,290 fms., 40° bu. m. s.
3	38669	Off Nantucket Shoals, U. S. B. F. Station 2217...	924 fms., 38° gy. m.
8	78233	Off Nantucket Shoals, U. S. B. F. Station 2710...	984 fms., gu. m.

[1] Type.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	38669	Off Nantucket Shoals, U. S. B. F. Station 2217...	924 fms., 38.1° gy. m. (figd.)
2	153667	Off Nantucket Shoals, U. S. B. F. Station 2682...	1,004 fms., gn. m. s.
3	38673	Off Martha's Vineyard, U. S. B. F. Station 2222.	1,537 fms., 36° gy. oz.
1	38672	South of Block Island, U. S. B. F. Station 2210..	991 fms., 38° glob. oz.
5	40258	South of Long Island, U. S. B. F. Station 2234...	816 fms., 39° gn. m.
1	38668	South of Block Island, U. S. B. F. Station 2203..	705 fms., 38° gn. m. s.
5	38671	South of Block Island, U. S. B. F. Station 2203..	Do.
1	76836	100 miles southeast of Block Island, U. S. B. F. Station 2748..................................	1,163 fms., 37° gn. m. form.
1	38670	South of Block Island, U. S. B. F. Station 2207..	1,061 fms., 38° gn. m.
1	35417	Off Delaware Bay, U. S. B. F. Station 2103......	1,091 fms., 39° glob. oz.
2	76835	100 miles southeast Delaware Bay, U. S. B. F. Station 2739..................................	811 fms., 38° gn. m.
1	38674	Off Delaware Bay, U. S. B. F. Station 2231......	965 fms., 38° gy. oz.
4	78232	Off Georges Bank, U. S. B. F. Station 2706......	1,188 fms., gy. oz. form.
1	78945	80 miles east of Chesapeake, U. S. B. F. Station 2729...	679 fms., 38° drk. gn. m.
1	38405	Off Hatteras, North Carolina, U. S. B. F. Station 2111...	938 fms., bu. m.
4	35622	Off Hatteras, North Carolina, U. S. B. F. Station 2115...	843 fms., 39° m. fne. s.

CADULUS (PLATYSCHIDES) SPECTABILIS Verrill.

Plate 17, fig. 9.

1885. *Cadulus spectabilis* VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 6, pt. 2, p. 432, pl. 44, fig. 19.

1889. *Cadulus spectabilis*, DALL, Bull. Mus. Comp. Zoöl., vol. 18, p. 429, in part and excluding St. Vincent record.

1889. *Cadulus spectabilis*, DALL, Bull. 37, U. S. Nat. Mus., p. 76, in part, pl. 46, fig. 19.

1898. *Cadulus* (*Polyschides*) *spectabilis*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 153, pl. 25, fig. 64, in part, and omitting St. Vincent reference.

1903. *Cadulus spectabilis* DALL, Bull. 37, U. S. Nat. Mus., p. 76, pl. 46, fig. 19, in part.

The shell is very large, solid, evenly and moderately curved, with a gibbous swelling just back of a conspicuously constricted very oblique anterior aperture. The convex arc is slightly bulged out at the point of maximum caliber, and thence dips quickly in a flattened curve to the anterior aperture. The concave arc is more strongly curved posteriorly; the second half of it is rather straight and conspicuously convex at the equator, from which point it slopes suddenly to the anterior aperture. The swelling is marked at its section of maximum diameter by an obtuse angle. The anterior aperture is flattened, especially on the dorsal margin. The apical aperture is relatively small, slightly flattened, and cut by four slits, of which the two laterals are deeper and the dorsal and ventral ones are shallow and inconspicuous. This character, as in other species of this group, is frequently confused by injury. Measurements are:

Length, 22 mm.; maximum diameter, 4 mm.; anterior aperture, 2 mm.; apical aperture, 1 mm. (type).

Length, 21.5 mm.; maximum diameter, 3.4 mm.; anterior aperture, 2 mm.; apical aperture, 1 mm. (U. S. B. F. Station 2570).

The type, Cat. No. 78626, U.S.N.M., was obtained at U. S. B. F. Station 2711, off Maryland, in 1,544 fathoms, bottom of globigerina ooze.

Other lots were taken by the *Albatross* from numerous stations off the New Jersey and Maryland coast in 1,457 to 1,859 fathoms.

This species is readily distinguished by its great size and the conspicuous obtusely angled swelling just behind the constricted aperture. It belongs to a group of very large *Caduli*, including *C. poculum*, *C. aequalis*, *C. grandis*, etc. To *C. poculum* and *C. elephas* it is closely related by reason of the extreme anterior position of the equator.

The following are the museum collection lots:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1]1	78626	Off Maryland, U. S. B. F. Station 2711	1,544 fms., glob. oz.
1	52093	Off Georges Bank, U. S. B. F. Station 2572	1,769 fms. gy. oz., 38°.
1	52092	Off Georges Bank, U. S. B. F. Station 2570	1,813 fms., 37° glob. oz.
1	78627	Off Nantucket, U. S. B. F. Station 2713	1,859 fms., br. oz.
1	38116	Off Nantucket Shoals, U. S. B. F. Station 2043	1,467 fms., 38° glob. oz.
3	78628	Off Nantucket Shoals, U. S. B. F. Station 2714	1,825 fms., br. oz.
1	78626	Off Nantucket Shoals, U. S. B. F. Station 2711	1,544 fms., glob. oz.
11	37935	Off Martha's Vineyard, U. S. B. F. Station 2221	1,525 fms., 36° gy. oz.
1	52091	200 miles southeast Martha's Vineyard, U. S. B. F. Station 2569.	1,782 fms., 37° gy. oz.
1	52090	200 miles southeast Martha's Vineyard, U. S. B. F. Station 2568.	1,781 fms., 37° gy. oz.
4	73051	Off Maryland, U. S. B. F. Station 2174	1,594 fms., gy. m.
2	78947	125 miles east of Chesapeake, U. S. B. F. Station 2723.	1,685 fms., gy. oz. form.

[1] Type.

CADULUS (PLATYSCHIDES) ELEPHAS, new species.

Plate 17, fig. 10.

1889. *Cadulus spectabilis*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 429, in part.
1889. *Cadulus spectabilis*, Dall, Bull. 37, U. S. Nat. Mus., p. 76, in part and not including figure.
1898. *Cadulus* (*Polyschides*) *spectabilis*, Pilsbry and Sharp, Tryon's Man. of Conch., vol. 17, p. 153, in part and not including figure.
1903. *Cadulus spectabilis*, Dall, Bull. 37, U. S. Nat. Mus., p. 76, in part and not including figure.

The shell is very large, solid, and heavy, rather strongly curved in the posterior portion and with the section of greatest diameter immediately back of a constricted oblique anterior aperture, which is at about the anterior fifth or sixth. The convex side forms a regular arch to the equator, and thence a straight sharp descent to the anterior aperture over a flattened surface. The concave line is more deeply arched in the posterior portion and then quite straight throughout the anterior third. It is not bulged out at the equator. The equator is obscurely marked by an obtuse angle. The anterior aperture is slightly flattened into a rounded oval outline. The apical orifice is relatively large, round, and thickened within. The color is cream white or ivory, instead of the bluish white usual in the Caduli.

The apical features are not well shown on the unique specimen, but dorsal and ventral widely chipped out notches are indicated. Measurements are:

Length, 17.5 mm.; diameter, 2.8 by 2.5 mm.; anterior aperture, 2.1 by 2 mm.; apical aperture, 1.4 mm.

The type is in the Museum of Comparative Zoology, Cambridge, Cat. No. 7741, and was dredged by the *Blake* at United States Coast Survey Station 230, off St. Vincent, West Indies, 464 fathoms, bottom of fine sand, temperature 41½° F. There are no specimens in the United States National Museum.

This species was referred by Doctor Dall and later by Pilsbry and Sharp to Verrill's *Cadulus spectabilis.* It is closely related to that species, but the shell is smaller and more curved and has a larger apical orifice and smaller section at its equator. The extreme anterior position of the equator makes the resemblance the more striking. In this respect it also resembles *C. poculum,* but it has, on the other hand, a much larger shell. It is also larger than *C. aequalis,* another of the large *Caduli* of this same group. The ivory white color may be no more than an individual feature, but if it proves to be a constant one it might be accepted as a specific character of some importance.

CADULUS (PLATYSCHIDES) POCULUM Dall.

Plate 17, fig. 8.

1889. *Cadulus poculum* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 429.
1889. *Cadulus poculum* Dall, Bull. 37, U. S. Nat. Mus., p. 76.
1898. *Cadulus* (*Gadila*) *poculum,* Pilsbry and Sharp, Tryon's Man. Conch., vol 17, p. 172, pl. 33, figs. 56, 57.

The shell is slender and strongly arcuate, especially in the posterior portion; it has a rather gibbous swelling, with an obtuse angled equator, especially noticeable on the convex side, at a point only about one-fifth the distance from its extremely oblique anterior aperture. Between the equator and the anterior aperture the shell is very conspicuously flattened "like the mouth of a whistle." The convex side shows a regular and rather strong curve to the point of maximum caliber at the obtusely angled equator, but thence on the anterior aperture along the flattened compressed surface of the shell it describes a straight line, even across the aperture to the opposite side. The concave side shows a strongly curved outline throughout its posterior half, but a less curved one anteriorly with a point of slight convexity at the swelling just back of the aperture. From the equator the shell posteriorly is slightly flattened, slender, and evenly tapering to a small apical orifice. The anterior aperture is very oblique (quite 45°) and transversely elliptical. The apical features are not clearly shown in the few museum specimens, but lateral projections from the margin of the orifice would indicate characters similar to those of *Cadulus pandionis;* that is, shallow circular cuts extending across the dorsal and ventral sides of the rim, leaving between them pointed lateral projections. Measurements are:

Length, 13.2 mm.; diameter, 2 by 2.5 mm.; anterior aperture, 1.75 mm.; apical aperture, 0.63 mm. (Dall).

Length, 12.2 mm.; diameter, 2.11 by 2.45 mm.; anterior aperture, 1.2 by 1.65 mm.; apical aperture, 0.83 mm.

Length, 12 mm.; diameter, 1.90 by 2.20 mm.; anterior aperture, 1.40 by 1.20 mm. (type).

The type, Cat. No. 95374, U. S. N. M., is from a lot of two specimens collected by the *Blake* at United States Coast Survey Station 226, off St. Vincent, in 424 fathoms, bottom of fine dark sand and temperature of 42.5° F.

In the museum collection is one other lot, Cat. No. 95380, U. S. N. M., consisting of a single abnormal specimen, also collected by the *Blake*, United States Coast Survey Station not recorded, in 640 fathoms, off Yucatan Bank.

CADULUS (PLATYSCHIDES) AEQUALIS Dall.

Plate 17, fig. 11.

1881. *Cadulus aequalis* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 34.
1889. *Cadulus aequalis* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 429, pl. 27, fig. 9.
1889. *Cadulus aequalis* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 9.
1898. *Cadulus* (*Gadila*) *aequalis*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 170, pl. 25, fig. 48.
1903. *Cadulus aequalis* Dall, Bull. 37, U. S. Nat. Mus., p. 76, pl. 27, fig. 9.

The shell is very large and moderately curved, with scarcely any perceptible swelling; the greatest diameter lies within the anterior fifth portion of the shell. The convex side curves regularly to a point just back of the anterior aperture, and thence for the short remaining distance to the aperture it is a straight line. The concave outline is quite regular throughout; its posterior portion perhaps showing a slightly greater degree of curvature. The anterior aperture is a little oblique, somewhat constricted, and almost round. The apical orifice is round and relatively large. No apical features are observable in the two museum specimens.

The type, Cat. No. 95373, U.S.N.M., is from a lot of two specimens taken by the *Blake* at United States Coast Survey Station 43, off Tortugas, in 339 fathoms, bottom temperature 45° F. It measures—length, 15 mm.; maximum diameter, 2.5 mm.; anterior aperture, 2 mm.; apical aperture, 1 mm.

This is the unique museum record. A Philadelphia Academy of Natural Sciences specimen, collected by Commander Rush on the "E. coast of Florida," is apparently referable to this species. The species is distinguished by its lack of most of the usual features of the genus. Indeed, it is a shell that might easily be mistaken for a *Dentalium*.

The following five species of *Cadulus* may be placed together by reason of all possessing relatively large apical orifices: *C. agassizii*, *C. catharus*, *C. parvus*, *C. foweyensis*, *C. portoricensis*.

CADULUS (PLATYSCHIDES) AGASSIZII Dall.

Plate 18, figs. 1, 3.

1881. *Cadulus agassizii* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 35.
1889. *Cadulus agassizii* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 430.
1889. *Cadulus agassizii* Dall, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 12 (*c*).
1898. *Cadulus* (*Gadila*) *agassizii*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 168, pl. 25, fig. 57.
1898. *Cadulus agassizii hatterasensis* Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 169, pl. 33, figs. 50–54.

The shell is fairly solid, moderately curved, and having its maximum diameter, which is not bulbous, at about the anterior third. The anterior aperture is constricted, oblique, and round. The apical orifice is slightly flattened and comparatively large, often seemingly as large as the other aperture. The convex arc is almost flat along the anterior half of the shell and is slightly bulged out at its point of maximum diameter. The swelling, however, is a gradual one and unmarked by any prominent equator or angle. Posteriorly the shell is not much attenuated, but terminates in a large, open, and slightly flattened apical orifice. The apical features consist of four very broad, shallow slits that form as many indistinctly marked lobes; the one on the concave side is the broadest, the lateral ones being reduced to mere points; the dorsal one is rather broad and bluntly pointed. In many specimens, however, only the lateral points on the rim of the apical orifice are noticeable. Measurements are:

Length, 9 mm.; maximum diameter, 2 mm.; anterior aperture, 1.25 mm.; apical aperture, 0.75 mm. (type).

Length, 8.75 mm.; maximum diameter, 1.75 mm.; anterior aperture, 1.10 mm.; apical aperture, 0.75 mm. (Sand Key).

The type is in the Museum of Comparative Zoology, Cat. No. 7746, and was taken by the *Blake* at United States Coast Survey Station 5, south of Marquesas Key, Florida, in 229 fathoms, bottom temperature 49.5° F.

This is a very abundant species in the Florida Keys region in from 75 to 299 fathoms, and also from the Hatteras region in from 87 to 293 fathoms ("*Cadulus agassizii hatterasensis*").

About 80 lots containing many hundreds of excellent specimens from the Gulf Stream edge along the lower Florida coast which have recently been received, together with some additional lots from the Hatteras region now in the museum collection, make possible a closer study of this species than was heretofore the case. The lack of sufficient characters to maintain Doctor Pilsbry's subspecies is evident. *C. agassizii* has not the bent "dog tooth" aspect of *C. pandionis*, with which it seems to have been confused. In general, the characteristic feature of the species is the very large and flattened apical orifice, suggesting a shell normally possessed of a longer neck, a portion of which has been accidentally broken off, leaving a somewhat wide and jagged opening. In examining but one or two specimens the real apical features would almost certainly be overlooked, as the rim of the apical orifice is generally chipped and more or less injured. The examination of many specimens under a glass soon suggests a certain plan or design in the apical breaks. It finally becomes clearly apparent that the uniformity in the mode of breakage is due to the projection of the four lobes already referred to.

The following are the lots in the museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	103463	Off Chesapeake Bay, U. S. F. C. Station 2265....	70 fms., 57.9° gn. m., g.
1	314638	Off Hatteras, North Carolina (John Ford collection).	293 fms.
3	329451	Off Hatteras, North Carolina, U. S. B. F. Station 2592.	120 fms., gy. s., 58°.
24	93123	.....do..	Do.
1	93146	Off Hatteras, North Carolina (22 miles east southeast), U. S. B. F. Station 2595.	63 fms., 75°, gy. s., brk. sh.
28	329904	Off Hatteras, North Carolina, U. S. B. F. Station 2600.	87 fms., gy. s., 71.5°.
107	94248	Off Hatteras, North Carolina (36 miles south ½ west), U. S. B. F. Station 2601.	107 fms., gy. s., 67.4°.
1	329908	Off Hatteras, North Carolina, U. S. B. F. Station 2602.	124 fms., s. r., 61°.
42	92126	Off Hatteras, North Carolina (36 miles south ½ west), U. S. B. F. Station 2602.	124 fms., s. r., 61°.
7	314639	Off Florida Keys, U. S. B. F. Stations 2639–47...	56–217 fms., co. s.
27	93129	Off Cape Fear (25 miles east southeast), U. S. B. F. Station 2614.	17 fms., gy. s.
1	93130	Off Cape Fear (27 miles east southeast), U. S. B. F. Station 2615.	18 fms., gy. s.
2	94078	Off South Carolina, U. S. B. F. Station 2314.....	159 fms., 47.4°, crs. s., bk. sp.
3	94127	Off South Carolina, U. S. B. F. Station 2316.....	99 fms., s., 57.2°.
8	314640 314640	Miami, Florida, off Government Cut, *Eolis* Station 311.	75 fms.
12	314641	Miami Florida, off Government Cut, *Eolis* Station 103.	20 fms.
10	314642	Miami, Florida, off Government Cut, *Eolis* Station 82.	83 fms.
1	314643	Off Fowey Light, Florida, *Eolis* Station 153.....	
6	314644	Off Fowey Light, Florida, *Eolis* Station 178.....	68 fms.
95	314645	Off Fowey Light, Florida, *Eolis* Station 361.....	75–100 fms.
74	314646	Off Fowey Light, Florida, *Eolis* Station 374.....	85 fms.
9	314647	Off Fowey Light, Florida, *Eolis* Station 363.....	85 fms.
19	314648	Off Fowey Light, Florida, *Eolis* Station 364.....	75–90 fms.
82	314649	Off Fowey Light, Florida, *Eolis* Station 356.....	55 fms.
11	314650	Off Fowey Light, Florida, *Eolis* Station 360.....	100 fms.
60	314651	Off Fowey Light, Florida, *Eolis* Station 362.....	95 fms.
114	314652	Off Fowey Light, Florida, *Eolis* Station 375.....	75–90 fms.
2	314653	Off Fowey Light, Florida, *Eolis* Station 357.....	45 fms.
6	314654	Off Fowey Light, Florida, *Eolis* Station 177.....	60 fms.
34	314655	Off Fowey Light, Florida, *Eolis* Station 174.....	58 fms.
147	314656	Off Fowey Light, Florida, *Eolis* Station 355.....	70 fms.
52	314657	Off Fowey Light, Florida, *Eolis* Station 169.....	70 fms.
128	314658	Off Fowey Light, Florida, *Eolis* Station 352.....	90 fms.
2	314659	Off Fowey Light, Florida, *Eolis* Station 176.....	52 fms.
6	314660	Off Fowey Light, Florida, *Eolis* Station 182.....	75 fms.
20	314661	Off Fowey Light, Florida, *Eolis* Station 165.....	78 fms.
3	314662	Off Fowey Light, Florida, *Eolis* Station 179.....	70 fms.
13	314663	Off Fowey Light, Florida, *Eolis* Station 307.....	70 fms.
51	314664	Off Fowey Light, Florida, *Eolis* Station 353.....	85 fms.
18	314665	Off Fowey Light, Florida, *Eolis* Station 181.....	71 fms.
72	314666	Off Fowey Light, Florida, *Eolis* Station 354.....	80 fms.
15	314667	Off Fowey Light, Florida, *Eolis* Station 183.....	80 fms.
171	314668	Off Fowey Light, Florida, *Eolis* Station 373.....	70–90 fms.
5	314669	Off Fowey Light, Florida, *Eolis* Station 186.....	68 fms.
57	314670	Off Fowey Light, Florida, *Eolis* Station 382.....	70 fms.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
10	314671	Off Cape Florida, *Eolis* Station 189	67 fms.
33	314672	Off Ragged Key, Florida, *Eolis* Station 193	80 fms.
5	314673	Off Ragged Key, Florida, *Eolis* Station 365	75 fms.
50	314674	Off Ragged Key, Florida, *Eolis* Station 366	75–90 fms.
9	314675	Off Ragged Key, Florida, *Eolis* Station 192	75 fms.
75	314676	Off Ajax Reef, Florida, *Eolis* Station 137	40 fms.
5	314677	Off Ajax Reef, Florida, *Eolis* Station 369	80–100 fms.
39	314678	Off Ajax Reef, Florida, *Eolis* Station 370	70–90 fms.
192	314679	Triumph Reef, Florida, *Eolis* Station 350	70–90 fms.
83	314680	Caesar's Creek, Florida, *Eolis* Station 376	90 fms.
16	314681	Sambo Reef, Florida, *Eolis* Station 329	135 fms.
6	314682	Sambo Reef, Florida, *Eolis* Station 331	118 fms.
1	314683	Off Sambo Reef, Florida, *Eolis* Station 330	120 fms.
9	314684	Off Sambo Reef, Florida, *Eolis* Station 332	115 fms.
14	314685	Off Western Dry Rocks, *Eolis* Station 318	95 fms.
26	314686	Off Western Dry Rocks, *Eolis* Station 320	80 fms.
44	314687	Off Western Dry Rocks, *Eolis* Station 319	90 fms.
38	314688	Off Key West, Florida, *Eolis* Station 334	90 fms.
18	314689	Off Key West, Florida, *Eolis* Station 333	110 fms.
12	314690	Off Key West, Florida, *Eolis* Station 315	87 fms.
3	314691	Off Key West, Florida, *Eolis* Station 314	75 fms.
21	314692	Off Key West, Florida, *Eolis* Station 31	90 fms.
33	314693	Off Key West, Florida, *Eolis* Station 334	90 fms.
30	314694	Off Key West, Florida, *Eolis* Station 146	98 fms.
14	314695	Off Key West, Florida, *Eolis* Station 384	75–80 fms.
2	314696	Sand Key, Florida, *Eolis* Station 98	70–90 fms.
2	314697	Sand Key, Florida, *Eolis* Station 316	120 fms.
15	314698	Sand Key, Florida, *Eolis* Station 326	75 fms.
9	314699	Sand Key, Florida, *Eolis* Station 302	100 fms.
15	314700	Sand Key, Florida, *Eolis* Station 322	115 fms.
33	314701	Sand Key, Florida, *Eolis* Station 164	92 fms.
17	314702	Off Sand Key, Florida, *Eolis* Station 6	35 fms., s. brk. sh.
18	314703	Off Sand Key, Florida, *Eolis* Station 325	95 fms.
2	314704	Off Sank Key, Florida, *Eolis* Station 56	70 fms.
57	314705	Off Sand Key, Florida, *Eolis* Station 323	110 fms.
4	314706	Off Sand Key, Florida, *Eolis* Station 100	65 fms.
27	314707	Off Sand Key, Florida, *Eolis* Station 324	100 fms.
1	314708	Off Sand Key, Florida, *Eolis* Station 161	76 fms.
39	314709	Off Sand Key, Florida, *Eolis* Station 338	85 fms.
8	314710	Off Sand Key, Florida, *Eolis* Station 163	85 fms.
50	314711	Off Sand Key, Florida, *Eolis* Station 337	90 fms.

CADULUS (PLATYSCHIDES) CATHARUS, new species.

Plate 18, fig. 5.

The shell is rather solid, moderately curved, with its maximum diameter almost exactly median, where it is slightly bulged with just a suggestion of a bluntly carinated equator. The anterior aperture is very oblique, dorso-ventrally oval; its peristome is sharp, slightly constricted, and bordered on the outside by a flattened space as though "hollow ground." Within, it is encircled by an opaque white callus. The posterior orifice is relatively large, somewhat flaring, and a little flattened. The convex arc describes a regular curve unmodified by the equatorial expansion. The concave arc is reduced to an almost straight line, interrupted only by a slight bulge at the median equator. The posterior portion of the shell is not attenuated but free and large. Apical features, while not well shown in the type, are probably typical of the subgenus.

The type is in the State University of Iowa collection and was dredged by the expedition of that university of 1898, at the S. U. I. Station 115, off English Harbor, Antigua, in 120 fathoms. It measures: Length, 8.6 mm.; diameter, 2 by 1.75 mm.; anterior aperture, 1 by 1.2 mm.; apical aperture, 0.75 by 1 mm.

There are no examples in the National Museum collection. The median position of the equator, the localized swelling, the oval aperture, and the flattened, large apical orifice, are the chief characters of the species. A medium-power lens shows in an oblique light five transverse scratches on the polished vitreous surface, but these are hardly sufficient for diagnostic value. Its nearest ally is probably *Cadulus agassizii*, from which species, however, the median equator of *C. catharus* separates it.

CADULUS (PLATYSCHIDES) PARVUS, new species.

Plate 18, figs. 2; 4.

1889. *Cadulus amiantus* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 431, in part and omitting figure.
1889. *Cadulus amiantus* Dall, Bull. 37, U. S. Nat. Mus., p. 78.
1898. *Cadulus amiantus*, Pilsbry and Sharp, Tryon's Man. of Conch., vol. 17, p. 174, in part and omitting figure.
1903. *Cadulus amiantus* Dall, Bull. 37, U. S. Nat. Mus., p. 78.

A few lots in the National Museum collection that have been referred to *Cadulus amiantus*, together with some recently added lots from the Florida Keys region and from Barbados, upon careful comparison with the type of *C. amiantus*, must be renamed.

The following description is from a Barbados specimen: The shell is small, with a large, open, and gaping apical orifice and an oblique anterior aperture, very little, if any, larger than the posterior orifice. The equator is about median and without any local swelling. The convex outline forms a fairly regular arch, though it is somewhat flattened anteriorly. The concave outline is marked by a slight convexity at the equator. The shell is a little flattened on the concave side near the apical orifice and in the extreme posterior portion, imparting to it an oval shape; within this opening are some callous rings. The apical opening is modified by some shallow slits and broad, ill-defined lobes. Measurements are:

Length, 5.8 mm.; diameter, 1.1 mm.; anterior aperture, 0.8 mm.; apical aperture, 0.7 mm. (type).

Length, 5.5 mm.; diameter, 1.05 mm.; anterior aperture, 0.8 mm.; apical aperture, 0.7 mm.

Length, 6 mm.; diameter, 1.1 mm.; anterior aperture, 0.8 mm.; apical aperture, 0.8 mm.

This species groups with *C. agassizii* by reason of possessing the same flattened, large, and gaping posterior orifice, with an identical arrangement of apical slits. The chief difference lies in the smaller size of *C. parvus*, some specimens of which may slightly exceed 6 mm. in length, but the smallest *C. agassizii* are about 7 mm., with an average of 8 to 9 mm. in length, and they are, besides this, proportionally somewhat stouter and more inflated. Another difference lies in that the equator is more median in *C. parvus*.

The type, Cat. No. 95377 (*a*), U.S.N.M., was taken by the *Blake*, United States Coast Survey Station not given, off Barbados, in 100 fathoms.

A Yucatan specimen of *C. parvus*, from the great depth of 1,002 fathoms, can be explained by the steepness of the Yucatan continental slope and the likelihood of finding dead mollusks belonging to shallower stations that have been swept out to greater depth. A number of the Barbados specimens are slightly smaller than the type, and may indicate a sexual character, as the Barbadian lots often contain examples of both. At all events, I do not believe the slightly smaller shells are separable from the others, even subspecifically.

The following are the museum collection records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	314713	Barbados, U. S. C. S. Station ?	100 fms.
1	314714	Fowey Light, Florida, *Eolis* Station 356	55 fms.
1	314715	Fowey Light, Florida, *Eolis* Station 354	80 fms.
1	314716	Fowey Light, Florida, *Eolis* Station 155	43 fms.
2	314717	Fowey Light, Florida, *Eolis* Station 364	75-90 fms.
1	314718	Fowey Light, Florida, *Eolis* Station 176	52 fms.
1	314719	Fowey Light, Florida, *Eolis* Station 350	70-90 fms.
1	314720	Key West, Florida, *Eolis* Station 384	75-80 fms.
1	95378	Off Cape San Antonio, *Blake* Station	1,002 fms.
5	314919	Barbados, Iowa State University Station 3	75-80 fms.
3	314920	Barbados, Iowa State University Station 13	80 fms.
1	314921	Antigua, Iowa State University Station 115	120 fms.
5	314922	Barbados, Iowa State University Station 27	85-90 fms.
1	314923	Barbados, Iowa State University Station 61	33 fms.
2	314924	Barbados, Iowa State University Station 44	90-100 fms.

[1] Type.

CADULUS (PLATYSCHIDES) FOWEYENSIS, new species.

Plate 18, figs. 7, 13.

The shell is slender, slightly curved, very slowly enlarging from a comparatively large apical opening to the maximum section located one-fifth distance from the anterior aperture, thence it tapers moderately the remaining short distance to the relatively small contracted and oblique aperture. The shape is that of a long-necked large-mouth flask. The convex side is almost straight throughout its posterior half, and thence evenly arched to the aperture, only showing a slight prominence at the equator, just back of the anterior aperture. The concave side, on the contrary, is almost straight in its anterior half and thence evenly arched the balance of the way to the apical orifice. There are numerous opaque rings about the shell, especially near the posterior end, each ring being a slight thickening of the shell. The apical opening is wide and rather flaring, a very little flattened, and cut by four very shallow broad fissures, dividing the apical rim into four ill-defined lobes, the one on the convex side being slightly projecting and pointed, the lateral ones small, and the fourth one on the concave side being broad, low, and flat. It is unusual to find any one specimen showing all these lobes in good condition.

The type, Cat. No. 314721, U.S.N.M., was dredged at *Eolis* Station 350, off Triumph Reef, Florida, in 90 fathoms. It measures—length, 7 mm.; maximum diameter, 1.10 mm.; anterior aperture, 0.75 mm.; apical aperture, 0.60 mm.

There are also eight lots from off Fowey Light, Florida, in 55 to 90 fathoms, sandy mud bottom.

This is an easily recognized species of apparently very restricted range. The chief distinguishing character is the long produced "neck" of large diameter terminating in the large and somewhat flaring apical opening.

The museum collection contains the following lots:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	314721	Triumph Reef, Florida, *Eolis* Station 350	70-90 fms. (type).
2	314722	Fowey Light, Florida, *Eolis* Station 352	90 fms.
2	314723	Fowey Light, Florida, *Eolis* Station 373	70-90 fms.
1	314724	Fowey Light, Florida, *Eolis* Station 356	55 fms.
2	314725	Fowey Light, Florida, *Eolis* Station 364	75-90 fms.
1	314726	Fowey Light, Florida, *Eolis* Station 374	85 fms.
1	314727	Ragged Key, Florida, *Eolis* Station 365	75 fms.
1	314728	Caesars Creek Bank, Florida, *Eolis* Station 376	90 fms.

CADULUS (PLATYSCHIDES) PORTORICENSIS, new species.

Plate 18, fig. 6.

The shell is small, moderately curved, with greatest diameter at about the anterior third. There is no bulbous or local swelling, and the exact position of the equator is not very obvious. The convex side shows a rather even arc, but little modified between the equator and anterior aperture. The concave side is moderately arched in the posterior third, the balance being about straight, with a very slight convexity in the region of the equator. The cylinder is in general round, but it is slightly compressed laterally at the apical end, giving that orifice a rounded oval outline. The anterior aperture is oblique, with its peristome rounded and smooth. The apical features in the unique museum specimen show a possible *Polyschides* type, though modified, as in *Cadulus carolinensis*, to occupy an intermediate stage between *Platyschides* and *Polyschides*. There are four shallow slits creating as many lobes.

The type, Cat. No. 314712, U.S.N.M., was obtained at U. S. B. F. Station 6062, in Mayaguez Harbor, Porto Rico, in 25 fathoms, bottom of sand, mud and shells, temperature 75.8° F., and is the unique specimen. It measures—length, 7 mm.; diameter, 1 mm.; anterior aperture, 0.85 mm.; apical aperture, 0.5 mm.

This little *Cadulus* is removed from a lot of *C. nitidus* taken in Mayaguez roadstead. Its affiliations would appear to be with *C. carolinensis*, from which it differs chiefly in being smaller. In general shape it is of the group of *Caduli* that have no definite equator nor prominent localized swelling. Some uncertainty attaches to the apical features, which I hope may be removed by receipt of better material.

The following five species are characterized by a bent or crooked appearance, chiefly caused by the obliquity of the anterior aperture, together with an anterior position of the equator—a "dog-tooth" shape so often referred to by authors: *Cadulus rushii, C. pandionis, C. watsoni, C. vulpidens, C. providensis.*

CADULUS (PLATYSCHIDES) RUSHII Pilsbry and Sharp.

1898. *Cadulus* (*Gadila*) *rushii* Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 168, pl. 27, figs. 94–97.

The shell is moderately solid, the typical subspecies being large (11.5 mm.), another subspecies smaller (8.3 mm.). It is moderately curved, chiefly posteriorly, the convex side evenly arched throughout, though slightly accentuated at the equator, which is about one-fourth the distance from the anterior aperture. The concave side is nearly straight in the anterior half, but decidedly arched posteriorly; the section of greatest diameter is about one-fourth distance back of the anterior aperture, where the shell has a diffused moderate swelling, though not bulbous or gibbous. The entire shell is dorso-ventrally compressed, but less so at the two apertures. The larger aperture is oblique with a rounded peristome. The apical orifice is a little oval, with the rim indistinctly cut by four slits, leaving as many low flat lobes, the dorsal and ventral ones being the broadest, the former with an obtuse angle, the latter flat-topped and slightly flaring out. These features can rarely be observed in any single specimen, owing to accidental breaks. Measurements are:

Length, 11.6 mm.; maximum diameter, 2 by 1.8 mm.; anterior aperture, 1.6 by 1.4 mm.; apical aperture, 0.6 by 0.53 mm. (Type of *Cadulus rushii rushii.*)

Length, 8.3 mm.; maximum diameter, 1.3 mm.; anterior aperture, 1.2 mm.; apical aperture, 0.8 mm. (Type of *C. r. arne.*)

This is a fairly deep-water species, ranging from off Cape Hatteras to Nantucket, in 293 to 1,060 fathoms.

C. rushii occupies an intermediate position between *C. agassizii*, with the flattened, wide flaring posterior aperture of that species, and *C. pandionis*, with its longer, curved neck, and small apical orifice. It begins to assume the crooked appearance of *C. pandionis*, but differs again in its apical features. It is larger than *C. agassizii* and appears to inhabit a somewhat deeper water zone.

CADULUS (PLATYSCHIDES) RUSHII RUSHII Pilsbry and Sharp.

Plate 18, fig. 15.

This typical subspecies includes the larger forms described under *Cadulus rushii*, with a type measurement of—length, 11.6 mm.; diameter, 2 by 1.8 mm.; anterior aperture, 1.6 by 1.4 mm.; apical aperture, 0.6 by 0.53 mm.

The type is in the collection of the Philadelphia Academy of Sciences and was collected by Commander Rush, United States Navy, off Cape Hatteras, in 293 fathoms.

The following are the lots in the National Museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
4	190651	Marthas Vineyard, U. S. B. F. Station 1093	349 fms., 40°, bu. m. s.
6	202826	.....do	Do.
5	38177	.....do	Do.
7	203223	.....do	Do.
1	38682	Marthas Vineyard, U. S. B. F. Station 2222	1,537 fms., 36.9°, gy. oz.
1	202960	.....do	Do.
4	78237	Off Nantucket, U. S. B. F. Station 2710	984 fms., gn. m.
2	38675	Off Nantucket, U. S. B. F. Station 2192	1,060 fms., gn. oz. st.
7	202958	Off Block Island, U. S. B. F. Station 2203	705 fms., 38.9°, gn. m. s.
4	38676	.....do	Do.
1	202957	.....do	Do.
1	76663	Off Block Island, U. S. B. F. Station 2207	1,061 fms., 38.6°, gn. m.
3	203222	Off Marthas Vineyard, U. S. B. F. Station 999	266 fms., gn. m.
2	38769	Off Marthas Vineyard, U. S. B. F. Station 2212	428 fms., 40°, gn. m.
1	38655	Off Marthas Vineyard, U. S. B. F. Station 999	266 fms., gn. m.
1	50379	Off Georges Bank, U. S. B. F. Station 2529	662 fms., 39°, gn. m.
2	38648	Off Marthas Vineyard, U. S. B. F. Station 894	365 fms., 40°, br. m.
1	53009	Off Marthas Vineyard, U. S. B. F. Station 2581	394 fms., gn. m.
2	38647	Off Marthas Vineyard, U. S. B. F. Station 892	487 fms., br. m. s.
2	53077	Georges Bank, U. S. B. F. Station 2586	328 fms., 40.5°, gy. m.
1	38654	Off Marthas Vineyard, U. S. B. F. Station 997	335 fms., 40°, yl. m.
2	38652	Off Marthas Vineyard, U. S. B. F. Station 947	319 fms., 44°, s., m.
1	38656	Off Marthas Vineyard, U. S. B. F. Station 1028	410 fms., 41°, yl. m.
18	38680	Off Marthas Vineyard, U. S. B. F. Station 2213	384 fms., 39.5°, gn. m.
1	151910	Off Marthas Vineyard, U. S. B. F. Station 2547	390 fms., 40°, gn. m.
10	51160	.....do	Do.
6	202996	.....do	Do.
1	40240	South of Long Island, U. S. B. F. Station 2234	816 fms., 39°, gn. m.
1	202959	.....do	Do.
1	202838	Off Marthas Vineyard, U. S. B. F. Station 895	238 fms., 42°, sft. m.
2	202827	Off Marthas Vineyard, U. S. B. F. Station 1095	321 fms., 40°, gn. m.
1	202937	Off Nantucket, U. S. B. F. Station 2192	1,060 fms., 38.6°, gn. oz.
1	78236	Off New Jersey, U. S. B. F. Station 2709	866 fms., br. m.
2	203006	.....do	Do.
9	78237	Off New Jersey, U. S. B. F. Station 2710	984 ms., gn. m.
1	78948	Chesapeake Bay, U. S. B. F. Station 2729	679 fms., 38.5°, gn. For. oz.
1	202825	Chesapeake Bay, U. S. B. F. Station 898	300 fms., 44°, m.
3	38102	.....do	Do.
7	43986	Chesapeake Bay, U. S. B. F. Station 2263	430 fms., gn. m.
1	202956	.....do	Do.
2	35765	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2111.	938 fms., gn. m.
20	35623	Off Cape Hatteras, North Carolina, U. S. B. F. Station 2115.	843 fms., 39°, m., s.
4	94295	Off Cape Hatteras, North Carolina, *Blake* Station 35.	300 fms., gn. m. (Rush).

CADULUS (PLATYSCHIDES) RUSHII ARNE, new subspecies.

Plate 18, fig. 9.

This is a smaller form than *Cadulus rushii rushii* and hardly to be distinguished from it except in the matter of size, but the difference is sufficiently persistent to warrant a separation. Geographically it occupies the same range. The apical features of the shell are remarkably well shown in some specimens. These consist of four shallow slits and four lobes, the dorsal and ventral lobes low and broad, the lateral ones narrow, triangular, and pointed.

The type, Cat. No. 314729, U.S.N.M., measures—length, 8.3 mm.; diameter, 1.3 mm.; anterior aperture, 1.2 mm.; apical aperture, 0.8 mm. It was dredged at the U. S. B. F. Station 2234, off New Jersey, in 810 fathoms, bottom of green mud, temperature 38.6°.

The following are the National Museum lots:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 5	314729	Latitude 30–09–00, longitude 72–03–05, U. S. B. F. Station 2234.	810 fms., 38.6°, gn. m.
1	78237	Off New Jersey, U. S. B. F. Station 2710	984 fms., gn. m. (figd. specimen).
1	78237	do	984 fms., gn. m.
2	314730	Latitude 39–58–30, longitude 70–30–00, U. S. B. F. Station 2213.	384 fms., gn. m.
1	53084	Off Marthas Vineyard, U. S. B. F. Station 2584	541 fms., 40°, drk. gy. m.
2	38122	Off Marthas Vineyard, U. S. B. F. Station 2092	197 fms., 45°, gn. m.
1	314731	Off Marthas Vineyard, U. S. B. F. Station 1093	349 fms., br. m., s., 40°.
1	38677	South of Block Island, U. S. B. F. Station 2203	705 fms., 39°, gn. m., s.
1	53084	Off Marthas Vineyard, U. S. B. F. Station 2547	390 fms., 40°, gn. m.
2	78235	Off Block Island, U. S. B. F. Station 2689	525 fms., gn. m.
2	38660	Marthas Vineyard, U. S. B. F. Station 1140	374 fms., sft. m., p.
2	78237	Off New Jersey, U. S. B. F. Station 2710	984 fms., gn. m.
1	78630	Off Cape May, U. S. B. F. Station 2722	594 fms., gn. m.
2	78629	Off Maryland, U. S. B. F. Station 2721	813 fms., gy. oz.

[1] Type.

CADULUS (PLATYSCHIDES) PANDIONIS Verrill and Smith.

Plate 18, fig. 10.

1880. *Cadulus pandionis* (Verrill and Smith) VERRILL, Amer. Journ. Sci., vol. 20, pp. 392, 399.

1880. *Cadulus pandionis* VERRILL and SMITH, Proc. U. S. Nat. Mus., vol. 3, p. 395.

1882. *Cadulus pandionis* VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 5, p. 558, pl. 58, figs. 30, 30 (*a*).

1885. *Cadulus pandionis* VERRILL, Rep. of Com. Fish and Fisheries for 1883, Article 16, p. 573. Also Bush. Rep. of above, Art. 17, p. 717.

1898. *Cadulus* (*Gadila*) *pandionis*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 171, pl. 25, fig. 63.

1915. *Cadulus pandionis*, JOHNSON, Occ. Papers of Boston Soc. Nat. Hist., vol. 7, No. 13, Moll., p. 84.

The shell is large (10 to 11 mm.), strongly curved, gradually accelerating in diameter from a small apical orifice to the equator, at which point there is a considerable swelling, especially on the convex side; the section of maximum size is about one-third distance from the anterior aperture; the convex side describes a strong curve, but slightly interrupted at the equator, from which point the outline is straighter in its descent to the larger aperture. The concave side is more strongly curved posteriorly and shows at the point of maximum diameter a slight local convexity. The anterior aperture is oblique, with rounded peristome. The entire shell is somewhat flattened. When viewed upon its convex or concave side the shell is decidedly fusiform. The apical orifice is relatively small and its rim is modified by two semicircular shallow wide notches, dorsal and ventral, leaving two lateral bluntly pointed lobes. These are not, however, like the deep narrow lateral notches of the subgenus *Dischides*. Measurements are:

Length, 10 mm.; maximum diameter, 2.25 mm.; anterior aperture, 1.75 mm.; apical aperture, 0.4 mm. (Type).

Length, 11 mm.; maximum diameter, 2 mm.; anterior aperture, 1.40 mm.; apical aperture, 0.6 mm. (Florida).

The type, Cat. No. 38644, U.S.N.M., was dredged by the *Fish Hawk* at U. S. B. F. Station 876 off Marthas Vineyard, in 120 fathoms, bottom of soft, sticky mud, temperature 53° F.

In the museum collection are lots from off Marthas Vineyard and Nantucket, in 85 to 386 fathoms; also from the Florida Keys region and off Cape Florida and Fowey Light, in 70 to 200 fathoms.

The Florida specimens are altogether typical. With all the American dredging records between these two regions it seems strange that none should record this species. Numerous lots of *Caduli* from the Hatteras region, so identified in the museum collection, upon more critical examination appear to be *C. agassizii* and *C. rushii*.

This well-marked species is at once recognizable by its peculiar apical characters and by the crooked or "dog tooth" shape, as of *C. vulpidens*, an appearance given by the slight obliquity of the equator. It is one of the very abundant species in the regions occupied.

The following are the lots in the National Museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	38644	Marthas Vineyard, U. S. B. F. Station 876.......	120 fms., 53°, sft. stk. m. (type lot).
1	38643	Marthas Vineyard, U. S. B. F. Station 874........	85 fms., 51°, sft. stk. m. (figured 1896).
1	38641	Marthas Vineyard, U. S. B. F. Station 871.......	115 fms., 49° (figured 1896).
6	93147	Off Newport, Rhode Island, U. S. B. F. Station 871.	115 fms., 49° (typical) m. s.
6	314732	Marthas Vineyard, U. S. B. F. Station 876.......	120 fms., 53°, sft. stk. m.
16	38640	Marthas Vineyard, U. S. B. F. Station 870.......	155 fms., m. fne. s.
1	50996	Marthas Vineyard, U. S. B. F. Station 2539......	133 fms., 48°, gn. s.
6	50997	Marthas Vineyard, U. S. B. F. Station 2555......	136 fms., 48°, gn. m. s.
2	38639	Marthas Vineyard, U. S. B. F. Station 869......	192 fms., 50°, fne. s.
1	38661	Marthas Vineyard, U. S. B. F. Station 1142......	322 fms., 41°, m. s. p.
5	38641	Marthas Vineyard, U. S. B. F. Station 871.......	115 fms., 49°, m. fne. s.
6	38642	Marthas Vineyard, U. S. B. F. Station 873.......	100 fms., 51°, sft. stk. m.
25	38644	Marthas Vineyard, U. S. B. F. Station 876.......	120 fms., 53°, sft stk m.
11	38645	Marthas Vineyard, U. S. B. F. Station 877.......	126 fms., 57°, sft. stk. m.
1	38651	Marthas Vineyard, U. S. B. F. Station 945.......	207 fms., 44° gn. m. s.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
2	53091	Marthas Vineyard, U. S. B. F. Station 2590	190 fms., 47° g. m. s.
1	38662	Marthas Vineyard, U. S. B. F. Station 1144	386 fms., 41° sft. m.
9	38659	Marthas Vineyard, U. S. B. F. Station 1095	321 fms., 40°, sft. gn. m.
2	38643	Marthas Vineyard, U. S. B. F. Station 874	85 fms., 51°, sft. stk. m.
3	38663	Marthas Vineyard, U. S. F. B. Station 1154	193 fms., s. m.
4	38650	Off Marthas Vineyard, U. S. B. F. Station 943	157 fms., 49°, m. s. sh.
2	53067	Off Marthas Vineyard, U. S. B. F. Station 2582	137 fms., 47°, gn. m.
4	103441	Off Marthas Vineyard, U. S. B. F. Station 2583	137 fms., 47.5°, gn. m. s.
2	221641	Off Marthas Vineyard, U. S. B. F. Station 2541	134 fms., 48°, gn. s. sh.
4	314733	Miami, Florida, *Eolis* Station 312	25 fms.
1	314734	Off Key West, Florida, *Eolis* Station 333	110 fms.
6	314735	Fowey, Florida, *Eolis* Station 364	75–90 fms.
25	314736	Fowey, Florida, *Eolis* Station 371	110 fms.
108	314737	Fowey, Florida, *Eolis* Station 372	100 fms.
47	314738	Fowey, Florida, *Eolis* Station 359	100 fms.
195	314739	Fowey, Florida, *Eolis* Station 358	125 fms.
4	314740	Miami, Florida, *Eolis* Station 115	100 fms.
5	314741	Off Fowey Light, Florida, *Eolis* Station 306	100 fms.
3	314742	Off Fowey Light, Florida, *Eolis* Station 352	90 fms.
18	314743	Off Fowey Light, Florida, *Eolis* Station 305	110 fms.
2	314744	Miami, Florida, *Eolis* Station 95	90 fms.
4	314745	Off Ragged Key, Florida, *Eolis* Station 193	80 fms.
13	314746	Off Fowey Light, Florida, *Eolis* Station 303	185 fms.
40	314747	Off Fowey Light, Florida, *Eolis* Station 347	120 fms.
16	330522	Off Cape Florida, U. S. B. F. Station 2644	193 fms., 43.4°, g. s.
69	314748	Ragged Key, Florida, *Eolis* Station 339	100 fms.
116	314749	Fowey Light, Florida, *Eolis* Station 351	90 fms.
45	314750	Miami, off Government Cut, *Eolis* Station 310	118 fms.
101	314751	Fowey Light, Florida, *Eolis* Station 346	130 fms.
15	314752	Fowey Light, Florida, *Eolis* Station 349	100–150 fms.
43	314753	Fowey Light, Florida, *Eolis* Station 348	110 fms.
4	314754	Fowey Light, Florida, *Eolis* Station 374	85 fms.
2	314755	Caesars Creek, Florida, *Eolis* Station 376	90 fms.
33	314756	Fowey Light, Florida, *Eolis* Station 340	209 fms.
1	314757	Ragged Key, Florida, *Eolis* Station 194	85 fms.
24	314758	Fowey, Florida, *Eolis* Station 381	125 fms.
14	314759	Fowey, Florida, *Eolis* Station 377	190 fms.
6	314760	Fowey Light, Florida, *Eolis* Station 304	120 fms.
16	314761	Fowey, Florida, *Eolis* Station 378	165 fms.
2	82968	Fowey, Florida	150–200 fms. (Dr. Rush).
71	314762	Fowey, Florida, *Eolis* Station 379	140 fms.
32	314763	Fowey, Florida, *Eolis* Station 380	130 fms.
1	314764	Fowey Light, Florida, *Eolis* Station 353	85 fms.
2	314765	Fowey Light, Florida, *Eolis* Station 354	80 fms.
1	314766	East of Cape Florida, *Eolis* Station 189	67 fms.
1	97177	Five miles off Cape Florida, U. S. B. F. Station 2646.	85 fms., gn. s. form.

CADULUS (PLATYSCHIDES) WATSONI Dall.

Plate 18, fig. 12.

1881. *Cadulus watsoni* Dall, Bull. Mus. Comp. Zool., vol. 9, p. 34.

1889. *Cadulus watsoni* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 429, pl. 27, fig. 12*a*.

1898. *Cadulus* (*Gadila*) *watsoni*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 167, pl. 25, fig. 50.

The shell is slightly curved, the curvature being confined mostly to its posterior portion. The convex outline describes a regular arch with but little modification at the equator. The concave outline is strongly arched posteriorly and straight for its remaining two-thirds length, with a noticeable bulge at the equator. There is, however, no localized swelling. The section of maximum diameter is at about the anterior third, from which point to the larger aperture the convex surface of the shell is decidedly flattened. The anterior aperture is oblique and considerably compressed. The entire shell is somewhat compressed except at the posterior end. The apical characters which are very indistinct in the type, but are plainer in some other National Museum specimens, clearly appear to belong to a *Platyschides* type, as shown in *C. pandionis*; that is, two "chipped out" notches, dorsal and ventral, leaving two lateral lobes low and ill defined.

Measurements are:

Length, 13 mm.; maximum diameter, 2.9 mm.; minimum diameter, 2.25 mm.; anterior aperture, 1.5 mm.; apical aperture, 0.6 mm. (type).

Length, 14.3 mm.; diameter, 2 by 2.25 mm.; anterior aperture, 1 by 1.25 mm.; apical aperture, 0.6 mm. (Old Providence.)

The type is in the Museum of Comparative Zoology collection, Cat. No. 7742, collected by the *Blake* off Cape San Antonio, Cuba, in 413 fathoms.

The only museum lot consists of five specimens, Cat. No. 94054, U.S.N.M., collected at the U. S. B. F. Station 2150, off Old Providence Island in 382 fathoms, bottom of white coarse sand, temperature 45.75° F.

This *Cadulus* is one of the *agassizii, rushii, pandionis* group, but is larger than any of those species. It is very highly polished and likely belongs to the deeper Antillean continental slope zone.

CADULUS (PLATYSCHIDES) VULPIDENS Watson.

Plate 18, fig. 8.

1879. *Cadulus vulpidens* Watson, Journ. Linn. Soc. London, vol. 14, p. 524.
1885. *Cadulus vulpidens* Watson, *Challenger* Rep. (Scaphopoda), p. 18, pl. 3, fig. 2.
1898. *Cadulus* (*Gadila*) *vulpidens*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 172, pl. 25, fig. 51.

The shell resembles the canine tooth of a carnivore, long, sharp, bent; obliquely swollen, the equator on convex side is at the anterior fourth and on the concave side at about the anterior third. The shell contracts more rapidly from equator to mouth. The curvature is greatest near the apical end. The aperture is oblique, its peristome sharp. The apical orifice is round, the edge "slightly gnawed," projecting a little on the convex curved side. Measurements are:

Length, 8.75 mm.; diameter, 1.79 mm.; anterior aperture, 0.9 mm.; apical aperture, 0.75 mm. (Watson).

The type is in the British Museum and was dredged by the *Challenger* off Culebra Island in 390 fathoms.

I have seen no authentic specimens. None of the lots in the National Museum collection tentatively assigned to this species seems quite to agree with Watson's figure or description. The oblique character of the equator is seeming rather than actual; this is caused by the obliqueness of the aperture. Neither is the shell actually "bent," but only appears to be so by reason of the obtusely angled equator, which is more prominently noticeable on the convex side.

CADULUS (PLATYSCHIDES) PROVIDENSIS, new species.

Plate 18, fig. 14.

The shell is moderately curved, rather slender and markedly swollen at about the anterior two-fifths, especially on the convex side, and has an obtusely angled equator. It is very little compressed. The aperture is very oblique, with rounded peristome. The convex outline forms an even arc to the equator, thence becomes a straighter line along a somewhat flattened surface to the anterior aperture. The concave side shows its chief curvature in the posterior one-fourth, with an almost straight outline the balance of the way, though bulged out somewhat at the equator. The lateral sides converge to the rather broad apical end and to the broader aperture at about the same angle. Details of the apical characters are not plain, but the convex side of the rim projects slightly in an obtusely angled lobe, while the opposite side tends to flare out, the lateral portions being broadly notched.

The type, Cat. No. 94055, U.S.N.M., measures—length, 8.5 mm.; diameter, 1.80 by 1.50 mm.; anterior aperture, 1 mm.; apical aperture, 0.6 mm. It was dredged at the U. S. B. F. Station 2150, off Old Providence Island, in 382 fathoms, bottom of white coarse sand, temperature 45.75° F., from a lot of three specimens.

Another lot of 14 specimens, Cat. No. 108176, U.S.N.M., is from the U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, sand, 46.3° F. None of these specimens is good, but they seem to be referable to *Cadulus providensis*.

This species probably differs but slightly from Watson's *vulpidens*, taken by the *Challenger* in 390 fathoms, off Culebra. The chief difference lies in the position of the equator, which in the form here described is more nearly central. They both belong to the same group of "wolf-tooth" species, a bent appearance caused by the obliquity of the aperture and the obtusely angular equator. It is larger than either *Cadulus amiantus* or *C. bushii*.

The following four species may be grouped together upon the common features of extreme length and slenderness with a markedly anterior position of the equator: *C. elongatus*, *C. greenlawi*, *C. arctus*, and *C. braziliensis*.

CADULUS (PLATYSCHIDES?) ELONGATUS, new species.

Plate 19, fig. 15.

The shell is exceedingly long and slender, slowly tapering from a very small apical orifice to the equator, which is placed at about the anterior one-fifth, and unmarked by local swelling. The convex outline is regularly curved to the equator, thence is almost straight to the anterior aperture. The concave outline is regularly curved in the posterior half, but almost straight anteriorly with a just perceptible convexity at the equator. The lateral outlines are almost straight, diverging but slowly from the very small apex through the long "neck" of the shell to its section of maximum diameter, thence converging slowly through the short remaining distance to the larger aperture. On the convex side the shell is much flattened between the equator and the very oblique aperture, causing its peristome to describe an irregular oval. Throughout, the shell is somewhat compressed, even the apical orifice showing a slightly flattened circle. Apical characters are not clearly shown, but a slight flare of the rim with certain irregularities indicate a probable *Platyschides* affiliation.

The type, Cat. No. 323596, U.S.N.M., measures—length, 14.10 mm.; diameter, 1.50 by 1.75 mm.; anterior aperture, 1.40 by 1 mm.; apical aperture, 0.4 mm. It was dredged at the U. S. B. F. Station 2378, off the mouth of the Mississippi River, in 68 fathoms, bottom of gray mud. It is a unique specimen.

This species is easily recognizable by its extreme length and slenderness. At first glance it might be associated with *Cadulus acus* but it belongs rather to the group of *C. arctus* and *C. braziliensis.* The shell is curiously marked by broken circles of opaque ivory white alternating with translucent ones. I do not, however, believe this to be a specific character. This same feature may be noted in *C. braziliensis.*

CADULUS (PLATYSCHIDES) GREENLAWI, new species.

Plate 18, fig. 11.

The shell is rather strongly curved, elongate, very slender, gradually increasing from a very small apical orifice to the equator, which is located at about the anterior one-third; thence the caliber of the shell rather suddenly contracts and then more slowly diminishes to the anterior aperture. The entire shell is somewhat compressed except near the apical end, where the section is round. The convex outline describes an even curve, though a little straightened from the equator to the larger aperture. The concave outline is more strongly arched posteriorly and is slightly bulged out at the equator. From the equator anteriorly the cylinder is decidedly flattened, imparting to the anterior aperture a transversely oval shape. The swelling at the equator is localized by reason of the contraction adjoining it anteriorly. The apical features are not clearly shown.

The type, Cat. No. 314767, U.S.N.M., measures—length, 11 mm.; diameter, 1 by 1.25 mm.; anterior aperture, 1 mm.; apical aperture, 0.25 mm. It was dredged by the *Eolis* at its Station 380, off Fowey Light, Florida, in 130 fathoms, bottom of green mud. The type is the only specimen.

Unfortunately the aperture of the unique specimen is injured and can not be described, but there is no reason to suppose it to be different from others of the group so far observed. Although the equator is less anteriorly placed, this species belongs to the group of *Cadulus elongatus*. It is named after Capt. S. W. Greenlaw, master of the *Eolis*. Both this species and *C. elongatus* are greatly lengthened and very slender forms of a conventional type of *Cadulus*, and are not to be associated with the rather bizarre group that includes *C. acus* and *C. dominguensis*.

CADULUS (PLATYSCHIDES) ARCTUS, new species.

Plate 19, fig. 19.

The shell is exceedingly slender, very slightly flattened, moderately curved, slightly swollen, with a very small apical orifice and a small contracted oblique anterior aperture. The equator is at the anterior fourth and represents the point of maximum section rather than a local swelling. The convex side has an evenly arched outline almost unmodified at the equator although the cylinder is flattened on this side from the equator to the larger aperture. The concave side is more strongly curved posteriorly and shows a slight bulge at the equator; its posterior three-fourths tapers to an attenuated apical opening. The anterior aperture is transversely oval, with a rather sharp peristome. The apical orifice is almost round. The apical characters are not clearly shown in any of the Museum specimens. Measurements are:

Length, 11 mm.; diameter, 1.60 by 1.40 mm.; anterior aperture, 1 mm.; apical aperture, 0.40 mm. (type).

Length, 9 mm.; diameter, 1.50 by 1.20 mm.; anterior aperture, 0.90 mm.; apical aperture, 0.40 mm.

The type, Cat. No. 323955, U.S.N.M., was taken at the U. S. B. F. Station 2404 in the Gulf of Mexico, off Cape San Blas, Florida, in 60 fathoms, bottom of gray sand.

There are 10 specimens in this and one other lot, Cat. No. 151830, from the same station. This is a unique record.

Cadulus arctus is one of the most gracefully formed species of the genus. Its extreme slenderness and finely drawn out apical portion make it quickly recognizable among all other *Caduli* from the same region.

CADULUS (PLATYSCHIDES) BRAZILIENSIS, new species.

Plate 19, fig. 16.

The shell is elongate, slender, round, slightly curved, with its section of maximum diameter at about the anterior one-fifth, and is unmarked by any local swelling. The convex outline describes a regular arch, though slightly straightened between the equator and the anterior aperture, which area is a little flattened. The concave outline forms almost a curve, though rather straighter in its anterior half, and with no convexity or even interruption at the equator.

The lateral lines diverge slowly from a narrow small apical orifice to the equator, the exact position of which, when viewed on the concave side, is rather indefinite, and thence they converge more rapidly to the relatively broad anterior aperture. This aperture is considerably flattened on its convex side, giving to it an irregularly oval outline; it is also very oblique. The apical characters are not clearly shown, but seem not to be perfectly simple.

The type, Cat. No. 96113, U.S.N.M., measures—length, 8.50 mm.; diameter, 1.10 to 1.20 mm.; anterior aperture, 0.8 by 1 mm.; apical aperture, 0.35 mm. It was dredged by the *Albatross* at the U. S. B. F. Station 2762, east of Rio de Janeiro, in 59 fathoms, bottom of mud, temperature 57°, and is from a lot of two specimens.

One specimen exhibits a series of opaque white rings alternated by translucent spaces like zebra stripes. The type shows the same conditions in a modified degree. This species belongs in a group with *Cadulus arctus* and *C. elongatus* and those other species characterized by a slight expansion of the diameter at an anteriorly placed equator. From this group must be excluded, of course, those species of similar shape, but which fall under *Polyschides* by reason of their special apical characters.

The remaining species of *Platyschides* are not easily grouped, though each possesses some characters similar to those of one or another of the groups heretofore considered; these are *Cadulus bushii*, *C. lunula*, *C. simpsoni*, *C. miamiensis*, *C. amiantus*, and *C. nitidus*.

CADULUS (PLATYSCHIDES) BUSHII Dall.

Plate 19, fig. 10.

1889. *Cadulus carolinensis bushii* Dall, Bull. Mus. Comp. Zool., vol. 17, p. 430.
1898. *Cadulus* (*Polyschides*) *carolinensis bushii*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 153, pl. 33, figs. 58, 59.
1901. *Cadulus* (*Polyschides*) *carolinensis bushii* Dall and Simpson, Bull. U. S. Fish Com. for 1900, vol. 1, p. 457.

The shell is small, thin, moderately curved, with a small apical orifice, rather quickly expanding to the point of maximum diameter, situated at about the anterior third, thence narrowing to a somewhat constricted oblique anterior aperture. The convex side describes an almost uniform arc, save for a very slight bulge at the equator; the concave side shows its greatest curvature in its posterior third; thereafter it is almost straight but with a well marked convexity at the equator. There is a constriction just back of the larger aperture, which is quite oblique and with a rounded peristome. The cylinder is considerably compressed, causing the apical orifice to be somewhat oval, though the anterior aperture is round. Viewed ventrally, the lateral sides taper evenly from a wide equator posteriorly to the small apex and anteriorly to the larger aperture. The apical features are not clear in the type. Measurements are:

Length, 6.5 mm.; diameter, 1.25 mm. (Dall).

Length, 7 mm.; diameter, 1.10 by 1.30 mm.; anterior aperture, 0.75 mm.; apical aperture, 0.4 mm. (Barbados).

The type, Cat. No. 95376, U.S.N.M., is from Barbados, taken in 100 fathoms.

The distinguishing feature of this little shell is the decided dorsoventral compression which separates it at once from its nearest relatives—*Cadulus lunula* and *C. simpsoni.*

The following additional lots in the National Museum collection are all from the dredgings of the State University of Iowa Expedition to Barbados in 1918.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
3	314925	Barbados, S. U. I. Exp. Station 88	— fms.
4	314926	Barbados, S. U. I. Exp. Station 3	75–80 fms.
3	314927	Barbados, S. U. I. Exp. Station 51	35 fms.
5	314928	Barbados, S. U. I. Exp. Station 40	90 fms.
2	314929	Barbados, S. U. I. Exp. Station 69	60–70 fms.
3	314930	Barbados, S. U. I. Exp. Station 48	80 fms.
4	314931	Barbados, S. U. I. Exp. Station —	— fms.
1	95376	Barbados (*Blake* collection)	100 fms.

CADULUS (PLATYSCHIDES) LUNULA Dall.

Plate 19, fig. 12.

1881. *Cadulus lunulus* DALL, Bull. Mus. Comp. Zool., vol. 9, p. 35.

1889. *Cadulus lunula* DALL, Bull. Mus. Comp. Zool., vol. 18, p. 431, pl. 27, fig. 8, in part.

1889. *Cadulus lunula* DALL, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 8, in part.

1898. *Cadulus* (*Gadila*) *lunula*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 167, pl. 25, fig. 55, omitting Cape Lookout reference.

1903. *Cadulus lunula* DALL, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 8, in part.

Doctor Dall's type is a broken specimen, leaving both the diagnosis and the figure necessarily incomplete. I have hesitated to refer any National Museum specimens to the species, as the type fragment may be liberally interpreted to fit several of the smaller Antillean *Caduli.* However, a single specimen from Barbados in the museum collection seems to be referable with certainty to the species, despite the difference in depth station. The steepness of the continental shelf off northwest Cuba and the swiftness of the oceanic current that sweeps by it may account for the finding of a dead fragment at depths in excess of that of the natural habitat of the species. The supplemental description here given follows as closely as possible the original one, the additions being bracketed.

The shell is translucent [semitransparent], white, smooth, destitute of sculpture; dorsum (that is the concave outline) is nearly straight [except for a gentle arch in the posterior portion], slightly inflated [at the equator, which is located at about the anterior third; the convex side describes an uninterrupted arch]. The aperture is contracted and not flattened [except slightly laterally and is oblique]. [There is no local swelling or gibbosity at the equator, nor is the shell compressed unless very slightly so laterally.] The apical characters are not clear, but indicate indistinctly two lateral chipped but rounded notches, leaving bluntly pointed lobes on the convex and concave sides.

The type is in the Museum of Comparative Zoology collection, Cat. No. 7747, and measures—length, "6" mm.; diameter, 1.5 mm.; anterior aperture, 0.75 mm.; apical aperture, "0.87" mm. It was taken at United States Coast Survey Station 2, off Habana, Cuba, in 805 fathoms, bottom temperature 39.75° F.

This little *Cadulus* is easily distinguished from *C. bushii* by its lack of dorso-ventral compression and from all others by its slight lateral compression. The shell is more inflated than are any of the other species of similar length.

In the National Museum collection is a single specimen, Cat. No. 314940, U.S.N.M., dredged by the State University of Iowa, 1918, at their station 79, off Pelican Island, Barbados, in 70 fathoms.

CADULUS (PLATYSCHIDES) SIMPSONI, new species.

Plate 19, fig. 17.

1901. *Cadulus carolinensis bushii* Dall and Simpson, Bull. U. S. Fish Comm. for 1900, vol. 1, p. 457 (not of Dall, 1889).

The shell is small, slender, slightly curved, with its equator at about the anterior two-fifths or almost median and with no local swelling or bulbous appearance. The convex side presents a regular arch, even and unbroken; the concave side is almost a straight line except for some curvature at the posterior end and a slight convexity at the equator. The anterior aperture is a little contracted and laterally compressed, and is also quite oblique; the apical orifice is round; the shell is not conspicuously compressed or flattened, but is a trifle so laterally in its anterior portion. The apical characters are too indistinct for definite description, but are probably of the *Platyschides* type.

The type, Cat. No. 161580 (*a*), U.S.N.M., was taken at the U. S. B. F. Station 6062, Mayaguez roadstead, Porto Rico, in 25 fathoms, bottom of sand, mud, and shells, temperature 75.8° F., from a lot of 29 specimens. It measures—length, 7.5 mm.; diameter, 1.3 by 1.25 mm.; anterior aperture, 0.7 mm.; apical aperture, 0.4 mm.

In the National Museum collection are also a lot of six specimens, Cat. No. 314677, U.S.N.M., Ensenada de Cochinos, Cuba, 100 to 150 fathoms, from *Eolis* Station 232; a lot of four specimens, Cat. No. 314932, U.S.N.M., collected at the State University of Iowa Station 115, off English Harbor, Antigua, in 120 fathoms.

In that the shell of this species is slightly compressed laterally, its position is next to *Cadulus lunula.* It has a slightly larger shell than *C. bushii* and is again distinguishable from that species by its lateral compression—*bushii* having a very noticeable dorso-ventral compression. It is named for Mr. Charles T. Simpson, the joint author with Doctor Dall in the report upon the Porto Rican mollusks, referred to above.

CADULUS (PLATYSCHIDES) AMIANTUS Dall.

Plate 19, fig. 8.

1881. *Cadulus sauridens*, DALL, Bull. Mus. Comp. Zool., vol. 9, p. 36 (not of Watson, 1879).

1889. *Cadulus amiantus* DALL, Bull. Mus. Comp. Zool., vol. 18, p. 431; pl. 27, fig. 7, in part.

1889. *Cadulus amiantus* DALL, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 7, in part.

1898. *Cadulus* (*Gadila*) *amiantus*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 174, pl. 25, fig. 52, in part.

1903. *Cadulus amiantus* DALL, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 7, in part. (Not *C. amiantus*, Dall and Simpson, in Bull. U. S. Fish Commission for 1900, p. 457.)

The type of this species is a young and somewhat defective specimen that will not admit of the careful description these difficult little shells require. The only description given is a comparison of the shell with Doctor Watson's *Cadulus sauridens* and *C. vulpidens*, neither of which species do we know in this country save by the original descriptions. A careful comparison of the type with all the western Atlantic species of the group has resulted only in doubt and confusion owing to the imperfections of the type itself. The shell is smaller than any of the group except *C. nitidus*, which is more slender. Its nearest ally is *C. miamiensis*, which in turn is somewhat larger. The following supplemental diagnosis is given from the type of *C. amiantus:*

The shell is small, moderately curved, slender, with its section of maximum diameter about two-fifths distance from the anterior end; this does not amount to a local swelling, nor is the equator angled. The convex side presents an even uninterrupted arc, of which the anterior portion is somewhat flattened. The concave side has its greatest arc in the posterior third, its anterior half being almost straight with a slight convexity opposite the equator. From the equator on the convex side to the anterior aperture the cylinder is flattened very perceptibly, the balance of the shell being round. The larger aperture is oblique. The apical orifice is round and is neither very large or very small. The apical features show some modification from a simple rim, but no clear diagnosis can be made.

The type is in the collection of the Museum of Comparative Zoology, Cat. No. 7749, and measures—length, 5.75 mm.; diameter, 1.04 mm.

("1.4"). It was dredged by the *Blake* at the United States Coast Survey Station 19, off Bahia Honda, Cuba, in 310 fathoms, bottom temperature 52.25° F.

There are no examples in the museum collection.

CADULUS (PLATYSCHIDES) NITIDUS, new species.

Plate 19, fig. 9.

1901. *Cadulus amiantus* Dall and Simpson, U. S. Fish Comm. Bulletin for 1900, vol. 1, p. 457.

The shell is very moderately curved, slender, with its section of greatest diameter at about the oral third. There being no local swelling or bulging, the exact position of the equator is not clearly marked. The convex side shows an even uninterrupted arc. The concave side is almost a straight line with some slight curvature at the posterior end and with scarcely any convexity at the equator. The shell is round in section, there being no flattening at any point; viewed ventrally, the lateral lines converge but gradually from the narrow equator to a rather large apical orifice and to a relatively small anterior aperture. The last is but slightly oblique. The apical characters are very distinct, showing four shallow but well-marked notches separating as many lobes, the dorsal and ventral ones being the widest. Within the apical orifice is an opaque ring, though this may not always be present.

The type, Cat. No. 161582, (*a*), U.S.N.M., measures—length, 5.75 mm.; diameter, 0.9 mm.; anterior aperture, 0.75 mm.; apical aperture, 0.5 mm. It was collected at the U. S. B. F. Station 6062, in Mayaguez Harbor, Porto Rico, in 25 fathoms, bottom of sand, mud, and shells; temperature, 75.8° F. It is selected from a lot of 40 specimens.

These shells were originally identified as *C. amiantus*, but comparison with the type obliges me to remove them. They are smaller and more slender than are any other species placed near them in this review; these specimens show the apical features with the perfect definiteness of some species of *Polyschides*. *C. nitidus* is smaller than *C. portoricensis*, but otherwise very closely related.

CADULUS (PLATYSCHIDES) MIAMIENSIS, new species.

Plate 19, fig. 18.

The shell is rather strongly curved; the convex outline describes a fairly even arch, though flattened in its anterior portion between the aperture and the equator. The concave outline is more arched posteriorly though it is not quite a straight line from the equator to the aperture. The maximum diameter is about two-fifths distance from the anterior aperture. There is no local bulge nor swelling nor any trace of carination at the equator. The anterior portion of the shell is somewhat flattened on its convex side. The larger aperture is very oblique. The shell is semitransparent with many inner translucent rings of shelly deposit especially in the posterior end, or "neck." The apical characters show some modification from a mere simple rim but they are not distinct.

There is very little variation in size.

The type, Cat. No. 314772 (*a*), U.S.N.M., measures—length, 7.75 mm.; diameter, 1.5 mm.; anterior aperture, 1 mm.; apical aperture, 0.5 mm. It was dredged at *Eolis* Station 340, off Fowey Light, Florida, in 209 fathoms, bottom of fine sand.

This seems to be an abundant species of the Floridian upper continental shelf zone within the Gulf Stream area. It strongly resembles *Cadulus amiantus* but is larger. It is much larger than *C. nitidus*, less inflated than *C. lunula*, and lacks the lateral compression of *C. lunula* and *C. simpsoni* and the dorso-ventral compression of *C. bushii*.

The following are the museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
5	108176a	Charleston, North Carolina, U. S. B. F. Station 2668.	294 fms., 46.3°, gy. s. dd. co.
2	314769	Fowey Light, Florida, *Eolis* Station 303	135 fms.
1	314770	Fowey Light, Florida, *Eolis* Station 304	120 fms.
1	314771	Fowey Light, Florida, *Eolis* Station 306	100 fms.
25	314772	Fowey Light, Florida, *Eolis* Station 340	209 fms. (type).
16	314773	Fowey Light, Florida, *Eolis* Station 347	120 fms.
15	314774	Fowey Light, Florida, *Eolis* Station 348	110 fms.
4	314775	Fowey Light, Florida, *Eolis* Station 371	110 fms.
2	314776	Fowey Light, Florida, *Eolis* Station 353	85 fms.
10	314777	Fowey Light, Florida, *Eolis* Station 377	190 fms.
6	314778	Fowey Light, Florida, *Eolis* Station 378	165 fms.
1	314779	Fowey Light, Florida, *Eolis* Station 379	140 fms.
3	314780	Fowey Light, Florida, *Eolis* Station 381	125 fms.
9	314781		
2	330522	Cape Florida, Florida, U. S. B. F. Station 2644	193 fms., gn. s.

Subgenus GADILA Gray, 1847.

1847. *Gadila* Gray, Proc. Zool. Soc., p. 159. For full synonymy and discussion thereon see Pilsbry and Sharp in Tryon's Manual of Conchology, vol. 17, p. 162.

These authors first defined the subgenus by description, as follows:

> Shell decidedly curved; more or less swollen near the middle or toward the aperture; more tapering toward the apex; apical orifice not contracted by a callous ring; or, with such callous ring, weak and far within. Edges not slit. (Pilsbry and Sharp.)

The type is *Cadulus gadus* Montague.

The essential characters of *Gadila* are first, the simple rim of the apical orifice unmodified by any slits or lobes and second, the slenderness of the shells. This second feature is of less importance for there can be no strict division made between the more inflated forms of *Gadila* and the less obese forms of *Cadulus*, s. s.

Pilsbry and Sharp in their monograph just referred to placed under *Gadila* many species with shells having less distinct apical characters than the shells of *Polyschides*, to include which I have proposed the subgenus *Platyschides*.

By removal, then, from this subgenus to *Platyschides* of all those species with shells having shallow apical notches and lobes, the American representatives of *Gadila* are now reduced to a few species of small and even minute shells. These fall within four recognizable groups:

1. Those having shells of a "bent" or "canine tooth" appearance owing to a slightly carinated equator and an oblique anterior aperture.
2. Those with small and even very small shells, having a median equator.
3. Those of uniform diameter throughout, with orifices of equal diameter.
4. Those with exceedingly slender, needle-like shells having the equator just back of the anterior aperture.

The dividing line between *Gadila* and *Platyschides* is often made obscure by the obliteration of apical characters through injury to the thin and fragile rim of the apical orifice. Were these subgenera based, however, upon any very solid foundation of biological characters their importance might demand a greater care in the referring of species to a fixed and exact place under them.

The species grouped under 1. are *Cadulus sauridens*, *C. rastridens*, and *C. mayori*.

CADULUS (GADILA) SAURIDENS Watson.

Plate 19, fig. 11.

1879. *Cadulus sauridens* WATSON, Journ. Linn. Soc. London, vol. 14, p. 525.

1885. *Cadulus sauridens* WATSON, *Challenger* Report (*Scaphopoda*) p. 19, pl. 3, fig. 4.

1898. *Cadulus* (*Gadila*) *sauridens*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 173, pl. 25, fig. 56.

The shell is small and narrow, slightly compressed, a little bent, with the equator about median, showing a swelling on the convex side. The convex side describes an even arc. The concave side has its greatest curvature posteriorly; elsewhere it is almost straight with a slight convexity at the equator. The anterior aperture is small, very oblique, and the peristome is thin. There are "very faint microscopical traces of longitudinal texture." The apical features are "chipped." Measurements are:

Length, 3 mm.; diameter, 0.5 mm.; anterior aperture, 0.25 mm.; apical aperture, 0.23 mm. (Watson).

The type is in the British Museum, and was dredged at the *Challenger* Station 24, off Culebra Island, in 390 fathoms, bottom of Pteropod ooze.

Watson's mention of a "chipped" apical rim makes doubtful the position of the species under *Gadila.*

It is less swollen than *Cadulus rastridens.* The swelling is more median and without the bluntly angulated equator of the latter.

The mention of a longitudinal sculpture does not set this apart from other species of *Cadulus,* for the suggestion of a shadow of sculpture when viewed in oblique light, may be detected in some specimens of all species, particularly if the imagination be as carefully focussed as the microscope.

I am unable to refer with satisfying assurance any shells in the Museum collection to this very conventionally shaped little *Cadulus.*

CADULUS (GADILA) RASTRIDENS Watson.

Plate 19, fig. 1.

1879. *Cadulus rastridens* Watson, Journ. Linn. Soc. London, vol. 14, p. 525.
1885. *Cadulus rastridens* Watson, *Challenger* Report (*Scaphopoda*), p. 19, pl. 3, fig. 3.
1898. *Cadulus* (*Gadila*) *rastridens,* Pilsbry and Sharp, Tryon's Man. Conch. vol. 16, p. 174, pl. 25, fig. 62.

The shell is very small, slightly compressed, narrow, "bent," with a swelling at about the anterior three-eighths which is faintly keeled at the equator. The anterior aperture is not oblique and is rather large. The convex side exhibits a rather straight outline from the apical end to the equator; thence, at an angle, again rather straight to the anterior aperture. The concave side describes a shallow arch with a very slight convexity at the equator. The apical orifice is relatively large and round. No apical features are mentioned besides the rim being "less chipped than the mouth (anterior aperture)." Measurements are:

Length, 3 mm.; diameter, 0.6 mm.; anterior aperture, 0.38 mm.; apical aperture, 0.25 mm. (Watson).

The type is in the British Museum, taken at *Challenger* Station 24, off Culebra Island, in 390 fathoms, bottom of Pteropod ooze.

In the museum collection are topotypes from author, Cat. No. 118774, U.S.N.M. Also a lot of four specimens, Cat. No. 108280, U.S.N.M., from the U. S. B. F. Station 2415, off Georgia, in 440 fathoms, bottom of sand, 45.6° F. Also a lot of 85 specimens, Cat. No. 108169, U.S.N.M., from the U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of gray sand and dead coral, temperature 46.3°; also 35 specimens, Cat. No. 108168, U.S.N.M., from the same station.

The "bent" appearance is the result of the break at the equator in the outline of the convex side, forming an angle between two rather straight lines. In most *Caduli* the outline of the convex side is more arched and the "break" is less apparent. The lack of obliqueness in the anterior aperture is striking.

CADULUS (GADILA) MAYORI, new species.

Plate 19, fig. 3.

The shell is very small, moderately curved, with its section of maximum diameter at about the anterior two-fifths and which is marked by a small bulbous swelling. In some specimens the equator is also marked by a very obtuse angle though not sufficiently prominent to impart to the shell that "dog-toothed" appearance so noticeable in the species of the *vulpidens* group. The convex outline is rather strongly arched, with a slight hump at the equator. The concave outline is not quite straight, there being two slightly concave areas before and after a decided convexity at the equator. The shell is not flattened. The anterior aperture is oblique with a rounded peristome. The apical orifice is about two-thirds as large, round, and usually has a callous ring or two within the opening. Apical features are apparently simple. Measurements are:

Length, 4 mm.; diameter, 0.9 mm.; anterior aperture, 0.55 mm.; apical aperture, 0.4 mm. (type).

Length, 3.7 mm.; diameter, 0.8 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.3 mm.

The type, Cat. No. 314783, U.S.N.M., was dredged at *Eolis* Station 33, east of Tortugas, in 16 fathoms, bottom of coral sand. The general shape and facies of this little *Cadulus* strongly suggests *Cadulus sauridens*, but it is persistently larger and seems to belong geographically more strictly to the Floridian region. It is probably of a somewhat lesser depth range.

The following lots are in the National Museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
1	314783	Tortugas, Florida, *Eolis* Station 33	16 fms. (type).
64	314784	.....do.	Do.
46	314785	Off Key West, Florida, *Eolis* Station 42	60 fms.
153	314786	Off Key West, Florida, *Eolis* Station 43	63 fms.
1	314787	Off Key West, Florida, *Eolis* Station 73	
42	314788	Miami, Florida, *Eolis* Station 48	60 fms., gn. m.
1	314789	Miami, Florida, *Eolis* Station 49	30 fms.
5	314790	Miami, Florida, *Eolis* Station 68	45 fms.
6	314791	Miami, Florida, *Eolis* Station 69	38 fms.
2	314792	Miami, Florida, *Eolis* Station 87	63 fms.
1	314793	Miami, Florida, *Eolis* Station 117	35–38 fms.
6	314794	Miami, Florida, *Eolis* Station 140	65 fms.
1	314795	Miami, Florida, *Eolis* Station 311	75 fms.
1	314796	Off Fowey Light, Florida, *Eolis* Station 128	60 fms.
2	314797	Off Fowey Light, Florida, *Eolis* Station 147	35 fms.
2	314798	Off Fowey Light, Florida, *Eolis* Station 152	40 fms.
2	314799	Off Fowey Light, Florida, *Eolis* Station 156	47 fms.
1	314800	Off Fowey Light, Florida, *Eolis* Station 167	65 fms.
1	314801	Fowey Light, Florida, *Eolis* Station 172	55 fms.
3	314802	Fowey Light, Florida, *Eolis* Station 179	70 fms.
2	314803	Fowey Light, Florida, *Eolis* Station 182	75 fms.
1	314804	Fowey Light, Florida, *Eolis* Station 186	68 fms.
1	314805	Fowey Light, Florida, *Eolis* Station 306	100 fms.
1	314806	Fowey Light, Florida, *Eolis* Station 354	80 fms.
3	314807	Fowey Light, Florida, *Eolis* Station 356	55 fms.
2	314808	Fowey Light, Florida, *Eolis* Station 360	100 fms.
3	314809	Fowey Light, Florida, *Eolis* Station 364	75–90 fms.
16	314810	Ajax Reef, Florida, *Eolis* Station 368	80–100 fms.

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
13	314811	Ajax Reef, Florida, *Eolis* Station 370	70–90 fms.
2	314812	Sambo Reef, Florida, *Eolis* Station 196	58 fms.
39	314813	Sand Key, Florida, *Eolis* Station 32	61 fms.
2	314814	Sand Key, Florida, *Eolis* Station 100	65 fms.
2	314815	Sand Key, Florida, *Eolis* Station 300	72 fms.
1	314816	Triumph Reef, Florida, *Eolis* Station 350	70–90 fms.
32	157809	Gulf of Mexico, U. S. F. C. Station 2404	60 fms., gy. s.
14	323953	Gulf of Mexico, off San Blas, Florida, U. S. F. C. Station 2404.	60 fms., gy. s.

The following six species fall within the Group 2, referred to under the description of the subgenus *Gadila;* they all have small or very small slender shells of median or submedian equator: *Cadulus minusculus*, *C. iota*, *C. subula*, *C. verrilli*, *C. regularis*, *C. atlanticus*.

CADULUS (GADILA) MINUSCULUS Dall.

Plate 19, fig. 4.

1889. *Cadulus minusculus* Dall, Bull. Mus. Comp. Zool., vol. 18, p. 432.
1889. *Cadulus minusculus* Dall, Bull. 37, U.S. Nat. Mus., p. 78.
1898. *Cadulus* (*Gadila*) *minusculus*, Pilsbry and Sharp, Tryon's Man. Concl., vol. 17, p. 164, pl. 32, fig. 42, 43.
1903. *Cadulus minusculus* Dall, Bull. 37, U. S. Nat. Mus., p. 78.

The shell is very small, fusiform, slightly curved, with a moderate swelling at a median equator; the anterior aperture is oblique, with a rounded peristome; the apical orifice is round, and has an internal translucent ring, about half the diameter of the aperture. The cylinder is slightly compressed. The convex outline is rather strongly arched but the concave outline is nearly straight with a slight convexity at the equator. The lateral outlines are arcuate. No apical features observable. Measurements are:

Length, 2.33 mm.; diameter, 0.616 by 0.58 mm.; anterior aperture, 0.34 mm.; apical aperture, 0.3 mm. (Pilsbry.)

A very slight range in measurement is noted.

The type, Cat. No. 93122, U.S.N.M., was obtained at the U. S. B. F. Station 2595, off Cape Hatteras, in 63 fathoms, bottom of gray sand and broken shells.

The very small size of these tiny mollusks, permitting them to slip through the meshes of any but very fine sieves, probably accounts for the single record from a region of so many dredging stations.

CADULUS (GADILA) IOTA, new species.

Plate 19, fig. 2.

1901. *Cadulus minusculus*, Dall and Simpson, Bull. U. S. Fish Comm., vol. 1 for 1900, p. 457 (not *minusculus* Dall, 1889).

The shell is very minute and somewhat swollen in its middle portion. The convex outline is regularly arched; the concave outline is almost straight, with a slight convexity at a median equator and with a slight concavity near each end. The lateral outlines are rather straight, with an angle at the equator. The cylinder is hardly flattened. The anterior aperture is oblique; the apical orifice is round and of about half the diameter of the larger aperture, and carries a callous rib just within the opening. The apical features are not clearly defined, but are probably simple.

The type, Cat. No. 161581, U. S. N. M., measures—length, 2 mm.; diameter, 0.5 mm.; anterior aperture, 0.3 mm.; apical aperture, 0.15 mm. It was dredged at the U. S. B. F. Station 6062, in Mayaguez Harbor, Porto Rico, in 25 fathoms, bottom of sand, mud and shells, temperature 75.8° F.

In the National Museum collection are also the following lots: three specimens, Cat. No. 323014, U.S.N.M., taken at the U. S. B. F. Station 2315, off Key West, Fla., in 37 fathoms, bottom of coral; one specimen, Cat. No. 314817, U.S.N.M., taken at *Eolis* Station 68, off Miami, Florida, in 45 fathoms; one specimen, taken off the Lazaretto, Barbados, in 80 fathoms, by the Iowa State University Expedition at their station 86, seems quite typical, although the length is about 2.25 mm.

This little mite of a shell is the smallest of this group of very small forms, and is one of the smallest of all mollusks. Although its measurements in fractions of millimeters do not seem to warrant it, yet when laid side by side with *Cadulus minusculus* it seems to be hardly half as large.

CADULUS (GADILA) SUBULA, new species.

Plate 19, fig. 5.

The shell is very small, exceedingly slender, moderately curved, and very slightly compressed. Its equator is median and is slightly swollen. The cylinder is a little flattened on its convex side just back of the anterior aperture. The convex outline is regularly arched with a scarcely perceptible modification at the equator. The concave outline has a convexity at the point of maximum diameter and a slightly concave arc above and below. Viewed on the concave face the lateral outlines present two almost parallel lines, somewhat deflected apart at the equator. The anterior aperture is round, oblique, and has a rounded smooth peristome. The apical orifice is a little flattened into an oval shape; and is not much smaller than the other aperture.

The type, Cat. No. 323113, U.S.N.M., measures—length, 3.50 mm.; diameter, 0.5 mm.; anterior aperture, 0.35 mm.; apical aperture, 0.275 mm. It was dredged by the *Albatross* at the U. S. B. F. Station 2352, off Bahia Honda, Cuba, in 463 fathoms, bottom of white coral mud, temperature 45° F. It is selected from a unique lot of two specimens.

This is the slenderest species of the group. It is also characterized by its exceedingly small size, feeble swelling, and its very regular curvature.

CADULUS (GADILA) VERRILLI, new species.

Plate 19, fig. 13.

1880. *Cadulus propinquus*, Verrill, Proc. U. S. Nat. Mus., vol. 3, p. 395 (not of Sars, 1878).

1880. *Cadulus propinquus*, Verrill, Amer. Journ. Sci., vol. 20, p. 392.

1880. *Cadulus jeffreysii*, Verrill, Amer. Journ. Sci., vol. 20, p. 392 (not of Monterosato, 1875).

1880. *Cadulus jeffreysii*, Verrill, Proc. U. S. Nat. Mus., vol. 3, p. 395 (not of Monterosato, 1875).

1882. *Cadulus propinquus*, Verrill, Trans. Conn. Acad. Arts and Sci., vol. 5, p. 568, pl. 58, figs. 31, 32 (not of Sars, 1878).

1882. *Cadulus jeffreysii*, Verrill, Trans. Conn. Acad. Arts and Sci., vol. 5, pt. 2, p. 559 (not of Monterosato, 1875).

1885. *Cadulus subfusiformis*, Verrill, in Rept. of Com. of Fish and Fisheries for 1883, p. 573 (not of Sars, 1865).

1885. *Cadulus propinquus*, Bush, in Rept. of Com. of Fish and Fisheries for 1883, p. 717 (not of Sars, 1878).

1885. *Cadulus jeffreysii*, Bush, in Rept. of Com. of Fish and Fisheries for 1883, p. 717 (not of Monterosato, 1875).

1889. *Cadulus jeffreysii*, Dall, Bull. Mus. Comp. Zool., vol. 17, p. 430 (not of Monterosato, 1875).

1898. *Cadulus* (*Gadila*) *jeffreysi*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 16, p. 164, pl. 32, figs. 44–46, in part and not including pl. 24, fig. 39).

1903. *Cadulus jeffreysi*, Dall, Bull. 37, U. S. Nat. Mus., p. 76 (not of Monterosato, 1875).

The shell is very small, rather stout, with its greatest diameter about median and not marked by a local swelling, and with a large oblique anterior aperture having a rounded peristome. The apical orifice is three-fourths the size of the larger aperture and is somewhat constricted. The convex outline forms a regular arch, slightly flattened anteriorly and rendered slightly concave just back of the apical opening. The concave side is almost a straight line, with a slight convexity at the equator. The lateral outlines are quite straight as the shell is not flattened and the apertures are of so nearly equal size. No apical features are observable.

The type, Cat. No. 38963, U.S.N.M., measures—length, 2.75 mm.; diameter, 0.75 mm.; anterior aperture, .50 mm.; apical aperture, 0.4 mm. It was obtained at the U. S. B. F. Station 871, off Marthas Vineyard, in 115 fathoms, bottom of mud and fine sand, temperature 49° F.

A critical comparison of these little shells with the many specimens in the Jeffreys collection under the names given in the synonymy above convinces me of the propriety of separating them specifically. The many lots in that collection named *Cadulus jeffreysi* include two, if not three, seemingly distinct species, one of which, from northern stations, approximates very closely our species, but this is not the *C. jeffreysi* of Monterosato described from the Mediterranean. In relation to the other species of the group so far considered, this is relatively the stoutest and has the largest apical orifice.

The following lots are in the National Museum collection:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	38693	Off Marthas Vineyard, U. S. B. F. Station 871....	115 fms., m. s., 49°.
7	38693	.....do..	Do.
1	38694	Off Marthas Vineyard, U. S. B. F. Station 873...	100 fms., 51°, sft, stk. m.
5	61144	Off Marthas Vineyard, U. S. B. F. Station 871...	115 fms. 49°, m. fne. s.

[1] Type.

CADULUS (GADILA) REGULARIS, new species.

Plate 19, fig. 14.

The shell is small, with a median equator, without a local swelling, round section; the anterior aperture is oblique; the apical orifice is large, slightly flattened, but not constricted. The convex outline is rather strongly arched, though not evenly so, its posterior portion being straighter. The concave outline is almost a straight line, modified by a convexity at the equator and a gentle concavity in its anterior portion. The apical features are not distinct, but are probably simple.

The type, Cat. No. 330676 (*a*), U.S.N.M., measures—length, 4.25 mm.; diameter, 1.1 mm.; anterior aperture, 0.6 mm.; apical aperture, 0.5 mm. It is from the U. S. B. F. Station 2660, off Cape Canaveral, Florida, in 504 fathoms, bottom of yellow foraminifera, temperature 45.7° F. There is in the collection another lot of one specimen, Cat. No. 330675, U.S.N.M., from the same station; also a lot of 50 specimens, Cat. No. 108278, U.S.N.M., from the U. S. B. F. Station 2415, off Georgia in 440 fathoms, bottom of sand, temperature 45.6° F.; also a lot of 100 specimens, Cat. No. 108175, U.S.N.M., from the U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of sand, temperature 46.3° F.

The shell is stouter than *Cadulus atlanticus* and larger than *C. verrilli* and *C. transitorius*. It is not quite bulbous enough to be included under the subgenus *Cadulus*. In the many dredgings made along the upper part of the continental shelf of eastern Florida, between 100 and 200 fathoms, no specimens of this species have been taken.

CADULUS (GADILA) ATLANTICUS, new species.

Plate 20, fig. 2.

1885. *Cadulus jeffreysi*, (?) Verrill, in Rept. of Com. of Fish and Fisheries for 1883, p. 573 (not of Monterosato, 1875).

1889. *Cadulus gracilis*, Dall, Bull. Mus. Comp. Zool., vol. 18, p. 432 (not of Jeffreys, 1877).

1889. *Cadulus gracilis*, Dall, Bull. 37, U. S. Nat. Mus., p. 78 (not of Jeffreys, 1877).

1898. *Cadulus gracilis*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p.165. in part.

1903. *Cadulus gracilis*, Dall, Bull. 37, U. S. Nat. Mus., p. 78 (not of Jeffreys, 1877).

The shell is small, slender, slightly curved, little swollen, with its section of maximum diameter about median. The cylinder is round at the equator, but considerably flattened or compressed posteriorly. The convex outline describes a fairly even arc, which is slightly flattened anteriorly. The concave outline shows a decided concavity with a scarcely perceptible convexity at the equator. The anterior aperture is oblique, almost round, with its peristome rounded. The apical orifice is flattened into an oval section and is relatively large and a little flaring. There are one or more callous rings within it. The apical characters are not positively determinable, but carry a suspicion of *Platyschides* features. Measurements are:

Length, 4.90 mm.; diameter, 1 mm.; anterior aperture, 0.55 mm.; apical aperture, 0.5 by 0.4 mm. (Type.)

Length, 4.75 mm.; diameter, 0.9 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.5 by 0.4 mm.

The type, Cat. No. 78238, U.S.N.M., was obtained at the U. S. B. F. Station 2682, off Nantucket, in 1,004 fathoms, bottom of green mud and sand.

This is the largest species of the series of *Caduli* comprising this group of very small slender forms. It is again characterized by the very decided compression of the posterior fourth of the shell with the resulting oval apical orifice; also by the median equator, consisting of only a very slight expansion of the cylinder. Although Jeffreys himself compared a specimen from the 843-fathom lot (station 2115) with specimens of his own *C. gracilis* from British waters, and accepted their specific identity, I feel it necessary to separate these Eastern and Western Atlantic forms. The two species are undeniably closely related, belonging to the same group, but the English specimens are smaller, more slender, and their apical orifices are not usually so decidedly flattened. In the comparison of these very small *Caduli* one senses certain differences that may result from some very slight cause, as the degree of posterior curvature, or the degree of the anterior flattening, or the angle of obliqueness of the aperture, or the exact relation of maximum diameter to the total length. These differences, if they hold good throughout, seem sufficient grounds for separation of individuals taken from two sides of a great ocean, even though one may not be able to set forth clearly in words these shell differences.

The following are the National Museum records:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 4	78238	South of Nantucket, U. S. B. F. Station 2682....	1004 fms., gn. m. s.
1	78240	Southeast of Nantucket, U. S. B. F. Station 2710.	984 fms., gn. m.
1	40477	South of Block Island, U. S. B. F. Station 2207..	1061 fms., 38° gn. m.
10	35626	Off Cape Hatteras, U. S. B. F. Station 2115......	843 fms., m. s., 39°.
2	35720	Off Cape Hatteras, U. S. B. F. Station 2110......	516 fms., 40°, bu. m.
7	322542	Off Cape Hatteras, U. S. B. F. Station 2115......	843 fms., m. s., 39°.
1	35626	.....do..	Do.
1	314818	Off Block Island, U. S. B. F. Station 2212.......	428 fms., gn. m.
1	314819	Off Delaware, U. S. B. F. Station 2234...........	810 fms., gn. m.

[1] Type.

The following species of unique character seems to stand alone among the *Caduli* of the Atlantic; it is the only one in Group 3 referred to in the consideration of the subgenus *Gadila*:

CADULUS (GADILA) CYLINDRATUS Jeffreys.

Plate 20, fig. 15.

1877. *Cadulus cylindratus* JEFFREYS, Ann. Mag. Nat. Hist., ser. 4, vol. 19, p. 158.

1882. *Cadulus cylindratus* JEFFREYS, Proc. Zool. Soc., p. 664, pl. 49, fig. 6.

1884. *Cadulus cylindratus*, VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 6, pt. 1, p. 220.

1898. *Cadulus* (*Gadila*) *cylindratus*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 166, pl. 24, fig. 26.

Two lots with a total of four specimens in the National Museum collection seem referable to Jeffreys' species. The American specimens average a trifle more in diameter as compared with the specimens in the Jeffreys collection but differ in no other character. They are probably the most featureless of all the *Caduli*. The American shells may be described as small, gently curved, slightly contracted at both ends, otherwise of about equal caliber. They have no swelling. The anterior aperture and the apical orifice are of about equal size, and both are round. The anterior one is slightly oblique. There are no recognizable apical features. Measurements are:

Length, 7.3 mm.; diameter, 1.7 mm.; anterior and apical apertures, 1.4 mm. (Verrill).

Length, 7 mm.; diameter, 1.25 mm.; anterior and apical apertures, 1 mm.

Length, 8.1 mm.; diameter, 1.87 mm. (Jeffreys).

In the museum collection are a lot of two specimens, Cat. No. 38030, U.S.N.M., from the U. S. B. F. Station 2041, off Nantucket Shoals, in 1,608 fathoms, bottom of globigerina ooze, temperature 38° F., and a lot of two specimens, Cat. No. 38692, U.S.N.M., from the U. S. B. F. Station 2221, south of Marthas Vineyard, in 1,525 fathoms, bottom of gray ooze, temperature 36.9° F.

Jeffreys' records are also abyssal from off the West Coast of Ireland. These little deep water shells are almost devoid of characters and look like unidentifiable fragments. This species is the only one so far known in our faunal area with approximately equal sized openings and can not very well be grouped with any other species.

The following two species, *Cadulus acus* and *C. dominguensis*, possibly identical, may be separated from all other known *Caduli* of our faunal areas by reason of their extreme slenderness and by the position of the equator immediately behind the anterior aperture so that the shells superficially appear to belong to the *Dentalia* rather than to the *Caduli*. This is the Group 4 referred to in the comments on the subgenus *Gadila*.

CADULUS (GADILA) ACUS Dall.

Plate 20, fig. 11, 13.

1889. *Cadulus acus* Dall, Bull. Mus. Comp. Zool., vol 18, p. 432, pl. 27, fig. 11.
1889. *Cadulus acus* Dall, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 11.
1898. *Cadulus* (*Gadila*) *acus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 191, pl. 36, fig. 27.
1901. *Cadulus acus* Dall and Simpson, Bull. U. S. Fish Comm. for 1900, p. 457.
1903. *Cadulus acus* Dall, Bull. 37, U. S. Nat. Mus., p. 78, pl. 36, fig. 27.

The shell is small, exceedingly slender, slightly curved, very gradually and evenly increasing in diameter from a very small apical orifice to the equator, situated immediately back of the anterior aperture, from which point the cylinder rather abruptly contracts in the short distance thence to the larger aperture. There is no local swelling and the shell is not flattened. Many growth lines upon the posterior one-third of the shell are emphasized into almost a sculptural feature of densely packed circular riblets. The surface in all the specimens of the type lot is remarkably variegated by bands of greater opacity of varying widths. The apical features are simple. Measurements are:

Length, 8 mm.; diameter, 0.75 mm.; anterior aperture, 5 mm.; apical aperture, 0.12 mm. (Dall).

The type, Cat. No. 95379, U.S.N.M., was collected by Couthouy in 30 fathoms, and is from a lot of many specimens.

In the National Museum collection are also a lot of specimens, Cat. No. 161583, U.S.N.M., from the U. S. B. F. Station 6062, in Mayaguez Harbor, Porto Rico, 25 fathoms, bottom of sand and mud, temperature 75.8° F.; one specimen, "Santo Domingo," Cat. No. 314820, U.S.N.M., from Sowerby and Fulton; lot of three specimens, Cat. No. 108173, U.S.N.M., from U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of gray sand, temperature 46.3° F. The deeper and colder water station of this last lot raises a doubt as to the proper identification of these shells. However, the likelihood of the dead specimen being swept off the Bahaman platform near-by may be considered.

Other lots in the Philadelphia Academy of Natural Sciences collection are from Charlotte Amalia Harbor, St. Thomas, 5 fathoms;

Monkey River, British Honduras; Porto Barrios and Livingston, Guatemala; Belize Harbor.

These sharply pointed little shells have a superficial resemblance to *Dentalium* tips and are lacking in many of the conventional *Cadulus* characters. The fact that the equator and peristome do not coincide removes at once the suspicion of *Dentalium* when the specimens are carefully examined. The two species—*Cadulus elongatus* and *C. greenlawi,* heretofore described—resemble *C. acus* in the general elongate slender form, but their more posterior position of equator and their flattened dorsal area just back of the aperture exclude them from the *acus* group.

CADULUS (GADILA) DOMINGUENSIS Orbigny.

Plate 20, fig. 3.

1853. *Dentalium dominguense* ORBIGNY, Sagra Hist. Cuba, Moll., vol. 2, p. 201, pl. 25, figs. 7, 8, 9 ("1846").

1878. *Dentalium dominguense,* ARANGO, Contrib. Fauna Mal. Cubana, p. 232.

1898. *Cadulus* (*Gadila*) *dominguensis,* PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 191, pl. 36, fig. 26.

Shell "lengthened, narrow, arcuate, smooth, and shining; apex acuminate. Aperture contracted, oblique, oval. L. 7."

The type is in the British Museum. Santo Domingo (Orbigny); Martinique (Orbigny); Cuba (Orbigny); Playa del Chivo, Cuba (Arango).

There are no authentic specimens in the National Museum. The very meager description of Orbigny makes any positive identification impossible, but it is certainly very closely allied to, if not identical with, Dall's *Cadulus acus.* Until a comparison can be made with the Orbigny type I have thought it better not to unite them specifically.

Subgenus CADULUS Philippi, 1884.

1884. *Cadulus* PHILIPPI, Enumeratio Molluscorum Siciliae, vol. 2, p. 209.

"Shell somewhat cask-shaped, short and obese, conspicuously swollen in the middle, tapering rapidly toward both ends; convex on all sides, though less so dorsally. Aperture with simple, thin peristome; anal orifice comparatively large, with simple edge contracted by a wide circular callus or ledge just within the opening." Type, *Cadulus ovum* Philippi from the Mediterranean. The above is quoted from Pilsbry and Sharp's clearer diagnosis of the subgenus.[1]

The subgenus includes the small very obese forms of *Caduli* which in some instances seem almost deformed by their large bulbous median swelling. In extreme examples, such as *C. ampullaceus* Watson, the two apertures are but slightly constricted openings at opposite ends of a globe-like shell. At the other extreme the divisional line between *Cadulus* and *Gadila* can not always be sharply drawn. As heretofore observed in the case of *Gadila* the value of the subgenus *Cadulus* is rather as an aid in grouping together a certain number of species by reason of a general similarity of form. Its biological significance is probably nil.

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[1] Tryon's Manual of Conchology, vol. 17, p. 156.

There are eight species of western Atlantic *Cadulus* at present known that clearly fall within the limits of this subgenus. They are specifically determinable chiefly upon their relative degrees of obesity and upon their size and general facies. A key would be of little use. These are *C. ampullaceus*, *C. exiguus*, *C. obesus*, *C. cucurbita*, *C. platensis*, *C. podogrinus*, *C. halius*, and *C. tersus*. Three species, *C. curtus*, *C. congruens*, and *C. transitorius*, occupy an intermediate position, not having fully developed the bulbous character of *Cadulus* s. s. Their assignment to either *Gadila* or *Cadulus* is entirely arbitrary.

CADULUS (CADULUS) CURTUS Watson.

Plate 20, fig. 7.

1879. *Cadulus curtus* WATSON, Journ. Linn. Soc. London, vol. 14, p. 527.
1885. *Cadulus curtus* WATSON, *Challenger* Report (*Scaphopoda*), p. 21, pl. 3, fig. 7.
1898. *Cadulus* (*Gadila*) *curtus*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 175, pl. 25, fig. 60.

The shell is short, broad, and semiobese, almost straight, narrowed at both ends, with an approximately median swelling, giving to its convex side a humpbacked appearance. The concave side is almost a stright line, though curved a little posteriorly, and with a considerable convexity at the equator. The section is almost round. The anterior aperture is rather large, slightly oblique, and has a thin edge. The apical orifice is small. Apical characters are doubtful, "chipped."

The type is in the British Museum and measures—Length, 2.5 mm.; diameter, 0.75 mm.; anterior aperture, 0.25 mm. (Watson). It was taken by the *Challenger* at its station 24, off Culebra Island, in 390 fathoms, bottom of Pteropod ooze.

This species is one of the numerous barrel-shaped forms placed under the section *Cadulus*. There are no examples in the National Museum collection, nor have I seen specimens.

CADULUS (CADULUS) CONGRUENS Watson.

Plate 20, fig. 10.

1879. *Cadulus curtus congruens* WATSON, Journ. Linn. Soc. London, vol. 14, p. 527.
1885. *Cadulus curtus congruens* WATSON, *Challenger* Report (*Scaphopoda*), pp. 21, 22, pl. 3, fig. 7 (*a*).
1898. *Cadulus curtus congruens*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 175, pl. 25, fig. 59.

The author describes his subspecies, here given full specific value, by comparison with the type of *Cadulus curtus*. It is one-third larger (length about 3.3 mm.) with less oblique aperture (?). The section is round instead of being slightly compressed, as in typical *C. curtus*

The type, in the British Museum, is from the same *Challenger* station as of *C. curtus* (24), off Culebra Island, West Indies, in 390 fathoms, bottom of Pteropod ooze.

I have seen no specimens and can not refer to the species with certainty any specimens in the National Museum. The fact that it is not a compressed shell, as is *C. curtus*, and that it is also one-third larger, seems sufficient evidence to warrant a specific separation.

CADULUS (CADULUS) TRANSITORIUS, new species.

The shell is very small, quite inflated, its greatest diameter being about median, but the equator is without any local swelling; the cylinder is decidedly compressed laterally, giving to the oblique aperture a somewhat oval outline, but the apical orifice is round, or in a subspecific form very slightly flattened. The convex outline forms a regular arc without irregularities at any point; the concave outline is actually concave only anteriorly, is bulged out at the equator, and is a straight line posteriorly. The apical orifice is somewhat constricted, but remains relatively large for the genus, and is girdled within by a circular shelf, showing from without as an internal white callous ring. The apical features are simple. Measurements are:

Length, 3 mm.; diameter, 0.90 by 0.75 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.4 mm. (type of typical subspecies).

Length, 3.5 mm.; diameter, 0.9 by 0.8 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.4 mm. (type of *C. t. barbadensis*).

This little *Cadulus* may eventually be connected by intermediates with *C. verrilli*, and thus be shown merely to constitute a southern race of that northern Gulf Stream species. It has, however, a more inflated shell than has *C. verrilli* and seems to stand upon the border line between the subgenera *Gadila* and *Cadulus*. I have included under the name a number of lots that vary slightly from the type, as I dislike to multiply the species of these minute *Caduli* without more abundant evidence. A lot from Old Providence is more particularly aberant in having the inflation more localized. These, with *C. verrilli*, *C. atlanticus*, and *C. mayori* resemble the species of a European group represented by *C. jeffreysi* Monterosato, and including *C. gracilis* Jeffreys and *C. propinquus* Sars; but a careful comparison with authors' examples of these eastern Atlantic forms convinces me of their specific differences, although superficially they appear to be so very much alike. On the other hand, it bears close affinities with the group of bulbous species under the subgenus *Cadulus*, and among which I believe it should be placed.

CADULUS (CADULUS) TRANSITORIUS TRANSITORIUS, new subspecies.

Plate 19, fig. 6.

The shell of this, the typical subspecies of *Cadulus transitorius*, is described under the heading of that species. It includes, however, only those forms having a round apical orifice. The type is somewhat smaller than that of the other subspecies recognized.

The type, Cat. No. 330589, U.S.N.M., was dredged by the *Albatross* at the U. S. B. F. Station 2654, off the Little Bahama Bank, in 660 fathoms, bottom of yellow ooze, temperature 39.3° F., and measures—length, 3 mm.; diameter, 0.9 by 0.75 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.4 mm.

Other lots in the museum collection are as follows:

Number of specimens.	Cat. No. U.S.N.M.	Locality.	Remarks.
[1] 1	330589	Little Bahama Bank, U. S. B. F. Station 2654....	660 fms., yl. oz., 39.3°.
1	330678	Off Cape Canaveral, Florida, Station 2660........	504 fms., 45.7°, yl. for.
119	108170	Off Fernandina, Florida, Station 2668............	294 fms., 46.3°, yl. s. dd. co.
5	323779	Gulf of Mexico, off Cape San Blas, U. S. B. F. Station 2399.	196 fms., 51.6°, gu. m.
1	323813	Gulf of Mexico, off Cape San Blas, U. S. B. F. Station 2400.	169 fms., gu. m.
2	314821	Caesar's Creek, Florida, *Eolis* Station 376........	90 fms.
2	314822	Fowey, Florida, *Eolis* Station 381.................	125 fms.
2	314823	Old Providence Island, north of Colon, U. S. B. F. Station 2150.	382 fms., wh. crs. s.

[1] Type.

CADULUS (CADULUS) TRANSITORIUS BARBADENSIS, new subspecies.

Plate 19, fig. 7.

One specimen in the United States National Museum collection from Barbados, taken in 100 fathoms, and which had been referred to Monterosato's *Cadulus jeffreysi*, must be removed from that Mediterranean species, although it is closely related. It is only separable from *C. t. transitorius* in its greater measurement and in a slight degree of flattening of the apical orifice. The specimen is not a very good one, but the variation from the typical subspecies is obvious.

The type, Cat. No. 95375, U.S.N.M., measures—length, 3.5 mm.; diameter, 0.9 by 0.8 mm.; anterior aperture, .5 mm.; apical aperture, .4 mm. It was dredged by the Coast Survey steamer *Hassler* in 1871, off Sandy Bay, Barbados, in 100 fathoms.

A single specimen was also taken by the Iowa State University Expedition of 1918 in 80 fathoms, off Bridgetown, Barbados. This is a better specimen and gives a correct measurement of 4 mm. in length, the other dimensions being the same as of the type.

CADULUS (CADULUS) AMPULLACEUS Watson.

Plate 20, fig. 6.

1879. *Cadulus ampullaceus* WATSON, Journ. Linn. Soc. London, vol. 14, p. 529.

1885. *Cadulus ampullaceus* WATSON, *Challenger* Report (*Scaphopoda*), p. 23, pl. 3, fig. 11.

1898. *Cadulus* (*Cadulus*) *ampullaceus*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 158, pl. 25, fig. 58.

The shell is exceedingly small and bulbous, both the convex and "concave" outlines being very convex, though not equally so. The apertures appear to be but mere contractions at opposite ends of a bulbous swelling, forming two short projecting tubes. The equator is postmedian. The anterior aperture is large and slightly oblique. The apical orifice is slightly oval and smaller than the other, and is narrowed inside by a callous ring, reducing its caliber by about one-half. The margin of this ring is "formed by the projecting end of a short pipe, which passes up into the interior of the shell." No apical features are mentioned by the author. Measurements are:

Length, 2 mm.; diameter, 1.17 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.4 mm. (Watson.)

The shell "differs from *exiguus* in being rounder, has no tube anteriorly, is not nearly so elongated posteriorly, and is provided with a distinct posterior pipe." (Watson.)

The type is in the British Museum and was taken by the *Challenger* at station 24, off Culebra Island, in 390 fathoms, bottom of Pteropod ooze.

There are no specimens in the National Museum collection positively referable to this species. It is known to me only by Watson's description and figures. In this form the very extreme of the bulbous shell is reached.

CADULUS (CADULUS) EXIGUUS Watson.

Plate 20, fig. 9.

1879. *Cadulus exiguus* Watson, Journ. Linn. Soc. London, vol. 14, p. 528

1885. *Cadulus exiguus* Watson, *Challenger* Report (*Scaphopoda*), p. 23, pl. 3, fig. 10.

1898. *Cadulus* (*Cadulus*) *exiguus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 159, pl. 25, fig. 61.

The shell is very small, short, inflated, the bulbous swelling pinched in to form two projecting short tubes at the posterior and the anterior ends, the posterior tube being the smaller. The anterior aperture is large, not oblique, and thin edged. The apical orifice is small and narrowed within by an opaque callous ring forming a minute circular shelf. The apical features are described as "chipped." Measurements are:

Length, 1.9 mm.; diameter, 0.875 mm.; anterior aperture, 0.4 mm.; apical aperture, 0.25 mm. (Watson.)

The type is in the British Museum and was taken by the *Challenger* at Station 24 off Culebra Island, in 390 fathoms, bottom of Pteropod ooze.

A single specimen in the museum collection, Cat. No. 216663, U.S.N.M., is from the Bahamas, collected by the *Albatross*, but without station number or other record, and is referable to this species. One specimen was taken by the State University of Iowa Expedition at station 10, off Bridgetown, Barbados, in 100 fathoms.

CADULUS (CADULUS) OBESUS Watson.

Plate 20, fig. 8.

1879. *Cadulus obesus* WATSON, Journ. Linn. Soc. London, vol. 14, pp. 527, 528.
1881. *Cadulus obesus*, DALL, Bull. Mus. Comp. Zool., vol. 9, p. 36, in part.
1885. *Cadulus obesus* WATSON, *Challenger* Rept. (*Scaphopoda*), p. 22, pl. 3, fig. 8.
1889. *Cadulus obesus*, DALL, Bull. Mus. Comp. Zool., vol. 18, p. 431, in part.
1898. *Cadulus* (*Cadulus*) *obesus*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 159, pl. 25. fig. 53.

The shell is very small, short, inflated in the middle, narrowed at both ends, but more so posteriorly, very slightly curved and a trifle flattened. The convex outline is strongly arched and swollen centrally with a straighter very rapid descent from the equator to the anterior aperture. The "concave" outline is strongly bulged out centrally and is very little concave at any point and not at all so as a whole. The anterior aperture is large and not oblique. The apical orifice is smaller and has a callous ring within. The apical features are described as "chipped." Measurements are:

Length, 2.7 mm.; diameter, 1 mm.; anterior aperture, 0.5 mm.; apical aperture, 0.2 mm. (Watson).

The type is in the British Museum and is from the *Challenger* Station 24 off Culebra Island, in 390 fathoms, bottom of Pteropod ooze.

The only museum lot referable to this species is one of 20 specimens, Cat. No. 108171, U. S. N M., dredged by the *Albatross* at the U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of gray sand, temperature 46.3°. Doctor Dall refers to this species a lot from the United States Coast Survey Station 20, off Bahia Honda, in 200 fathoms. It is in the Museum of Comparative Zoology collection. The shells differ from Doctor Watson's *C. exiguus* only in size, the relative proportions being substantially the same.

CADULUS (CADULUS) CUCURBITUS Dall.

Plate 20, fig. 1.

1881. *Cadulus cucurbitus* DALL, Bull. Mus. Comp. Zool., vol. 9. p. 35.
1889. *Cadulus cucurbitus* DALL, Bull. Mus. Comp. Zool., vol. 18, p. 431, pl. 27, fig. 12 (*d*).
1889. *Cadulus cucurbitus* DALL, Bull. 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 12 (*d*).
1898. *Cadulus* (*Cadulus*) *cucurbitus*, PILSBRY and SHARP, Tryon's Man. Conch., vol. 17, p. 161, pl. 25, fig. 54.
1903. *Cadulus cucurbitus* DALL, Bull, 37, U. S. Nat. Mus., p. 78, pl. 27, fig. 12 (*d*).

This little *Cadulus* was decribed by Doctor Dall from a single specimen by comparing it with *C. obesus* Watson and *C. tumidosus* Jeffreys, between which it occupies an intermediate position. As authentic examples of these two species used for reference are not readily available a supplemental description may be of service.

The shell is small, obese, with its equator about median or slightly posterior. The cylinder is round, at no point flattened. The convex side is strongly arched with a slight concavity just forward of the apical orifice. The "concave" side is strongly bulged out at the equator and somewhat concaved between the equator and the two ends. The apical orifice is round, pinched, and small but without any prominent opaque rings or circular ledges within. The anterior aperture in the type is broken and shows no characters. The apical orifice is simple.

The type is in the Museum of Comparative Zoology, Cat. No. 7750, and measures—length, 4 mm.; diameter, 1.25 mm.; anterior aperture, 0.62 mm.; apical aperture, 0.37 mm. It is from the United States Coast Survey Station 19, off Bahia Honda, Cuba, in 310 fathoms, bottom temperature 52.25° F.

The only specimen in the National Museum collection referable to this species, Cat. No. 314934, U. S. N. M., is from Barbados and collected by the State University of Iowa Expedition, the depth record lost. The very inflated shape, median equator, round section, and pinched in apical orifice are the main characters. It seems not very different from Watson's *Cadulus obesus* except in that it is much larger. It is also more inflated than *C. halius*.

CADULUS (CADULUS) PLATENSIS, new species.

Plate 20, fig. 14.

1889. *Cadulus tumidosus*, Dall, Proc. U. S. Nat. Mus., vol. 12, p. 295 (not of Jeffreys, 1877).

1898. *Cadulus tumidosus*, Pilsbry and Sharp, Tryon's Man. Conch., vol. 17, p. 160, in part.

The shell is small and obese, thick and solid, with a median equator, marked indistinctly by an obtuse angle and not flattened. The median swelling is pronounced and bulbous. Both apertures are rather large, the anterior one being oblique. The convex outline describes a fairly regular deep curve; the concave outline is bulged out at the equator and scarcely incurved at any point. No apical features are observable.

The type, Cat. No. 330845 (*a*), U. S. N. M., measures—length, 5.5 mm.; diameter, 1.6 mm.; anterior aperture, 0.9 mm.; apical aperture, 0.75 mm. It is from the U. S. B. F. Station 2764, off Rio de la Plata, in 11½ fathoms, bottom of sand and broken shells.

The type lot consists of three imperfect shells, none of which shows clearly the apical or anterior apertures, but they do show the general shape of the shell. There is an unsual degree of variation shown in the amount of median swelling and in the distinctness of the angled equator. These same variations are shown in Jeffreys' *Cadulus tumidosus*, to which northern Atlantic species this species is certainly very closely allied. Our is a somewhat larger shell than *C. tumidosus*, but were both inhabitants of the same faunal area their specific identity could hardly be questioned.

Another lot consisting of but one very imperfect specimen, Cat. No. 95447, U.S.N.M., from the U. S. B. F. Station 2760, off Ceara, Brazil, in 1,019 fathoms, bottom of broken coral, temperature 39.5° F. is probably this species. It has an extraordinarily thick and heavy shell and possesses a decidedly carinate equator, thereby again suggesting Jeffreys' *C. tumidosus.*

Two more lots in the National Museum collection from the Gulf Stream off Florida and Georgia are also included, thus indicating for this species very extended geographical range. These are: Two specimens, Cat. No. 108279, U.S.N.M., taken by the *Albatross* at the U. S. B. F. Station 2415, off Georgia, in 440 fathoms, bottom of coarse sand, shells, and foraminifera, temperature 45.6° F.; and eight specimens, Cat. No. 108172, U.S.N.M., from the U. S. B. F. Station 2668, off Fernandina, Florida, in 294 fathoms, bottom of gray sand and dead coral, temperature 46.3° F.

The rather startling association of species from such divergent stations as a thousand fathoms and a littoral one of 11½ fathoms has been already presented by other forms taken by the *Albatross* from this same inshore haul, off the Rio de la Plata. Our very imperfect knowledge of the faunal conditions of the mollusks of the southeast coast of South America makes any explanation difficult. The correctness of the record is also to be questioned.

CADULUS (CADULUS) PODAGRINUS, new species.

Plate 20, fig. 5.

The shell is small, much inflated, and suddenly contracting into a short pinched-in dorso-ventrally flattened neck, terminating in an oval-shaped apical orifice. The convex outline forms a strongly curved arch from the point of contraction at the neck to the margin of the very oblique anterior aperture. On the short "neck" itself the same outline is actually concave. The "concave" outline is almost straight with a wide convexity at the equator which is slightly post median in position. Within the apical opening are callous rings. The apical features are simple.

The type is in the State University of Iowa collection. It measures—4.5 mm.; diameter, 1.25 mm.; anterior aperture, 0.75 mm.; apical aperture, 0.5 mm. It was dredged off English Harbor, Antigua, in 120 fathoms.

The extreme shortness of the posterior portion and the sudden contraction of the bulbous swelling, along with the posterior position of the equator, give to the shell a curiously humpbacked appearance. Its nearest ally is *Cadulus halius*, from which it differs in the humped appearance given by the sudden constriction of the bulbous portion. Both this and *C. halius* were taken in the same haul of the dredge, but among a number of specimens of each there are no intermediates.

A single specimen in the lot is smaller—length, 4.2 mm.; diameter, 1.1 mm., but otherwise agrees.

Topotypes, a lot of two specimens, Cat. No. 314935, U.S.N.M., dredged by the State University of Iowa Expedition at station 115, off English Harbor, Antigua, in 120 fathoms, are the only specimens in the National Museum collection.

CADULUS (CADULUS) HALIUS, new species.

Plate 20, fig. 12.

The shell is small, rather inflated, with a median equator, rather short and somewhat flattened, with an oval apical opening. The "neck" or posterior end is contracted, though not abruptly so. The convex outline posteriorly is a little concave, but is very convex over the bulging median portion and very slightly convex anteriorly. The concave outline is modified by a convex bulge in the median portion. The median equator is not marked by any carination. The anterior aperture is small and oblique. Some opaque rings within the apical orifice are quite noticeable. Apical features are simple.

The type is in the collection of the State University of Iowa, and measures—length, 5.5 mm.; diameter, 1.3 mm.; anterior aperture, 0.6 mm.; apical aperture, 0.5 mm. It was dredged off English Harbor, Antigua, in 120 fathoms.

This species resembles *Cadulus podagrinus* in several features, but lacks the exaggerated humpbacked appearance. The bulbous portion of the shell more slowly contracts into the pinched-in neck and has a more median position of the equator. Although the two species inhabit the same localities, there are no intermediates among the specimens before me.

Cotypes, a lot of four specimens, Cat. No. 314936, U.S.N.M., were obtained by the State University of Iowa Expedition of 1918 at station 115, in 120 fathoms, off English Harbor, Antigua.

CADULUS (CADULUS) TERSUS, new species.

Plate 20, fig. 4.

The shell is small, rather strongly curved, with very small apertures. The equator is slightly anterior to a median position and marks a pronounced local swelling. The convex outline describes an even deep arc; the concave outline has a convex bulge at the equator. The neck or posterior portion is quite long and round, ending in a very small round apical opening. The anterior aperture is not oblique, but is slightly oval, the anterior portion of the shell being a little flattened dorso-ventrally. Just within the apical orifice is a callous ring. The lateral outlines viewed dorsally or ventrally taper evenly from the equator to the small ends, giving a fusiform shape to the cylinder. The apical features are simple.

The type is in the State University of Iowa collection and measures—length, 3.1 mm.; greater diameter, 0.8 mm.; lesser diameter, 0.7 mm.; anterior aperture, 0.35 mm.; apical aperture, 0.2 mm. It was taken at the State University of Iowa Expedition Station 51, off Barbados, in 33 fathoms.

This fusiform little shell resembles a very small *Cadulus bushii*, but its localized swelling and very small openings and simple apex seem to denote a position under the subgenus *Cadulus*. It differs from all the others of the group in its fusiform shape, caused by the evenly converging lateral outlines. In the museum collection is a single specimen, Cat. No. 314937, U.S.N.M., collected by the State University of Iowa Expedition of 1918 at station 80, off Bridgetown, Barbados, in 40 to 75 fathoms.

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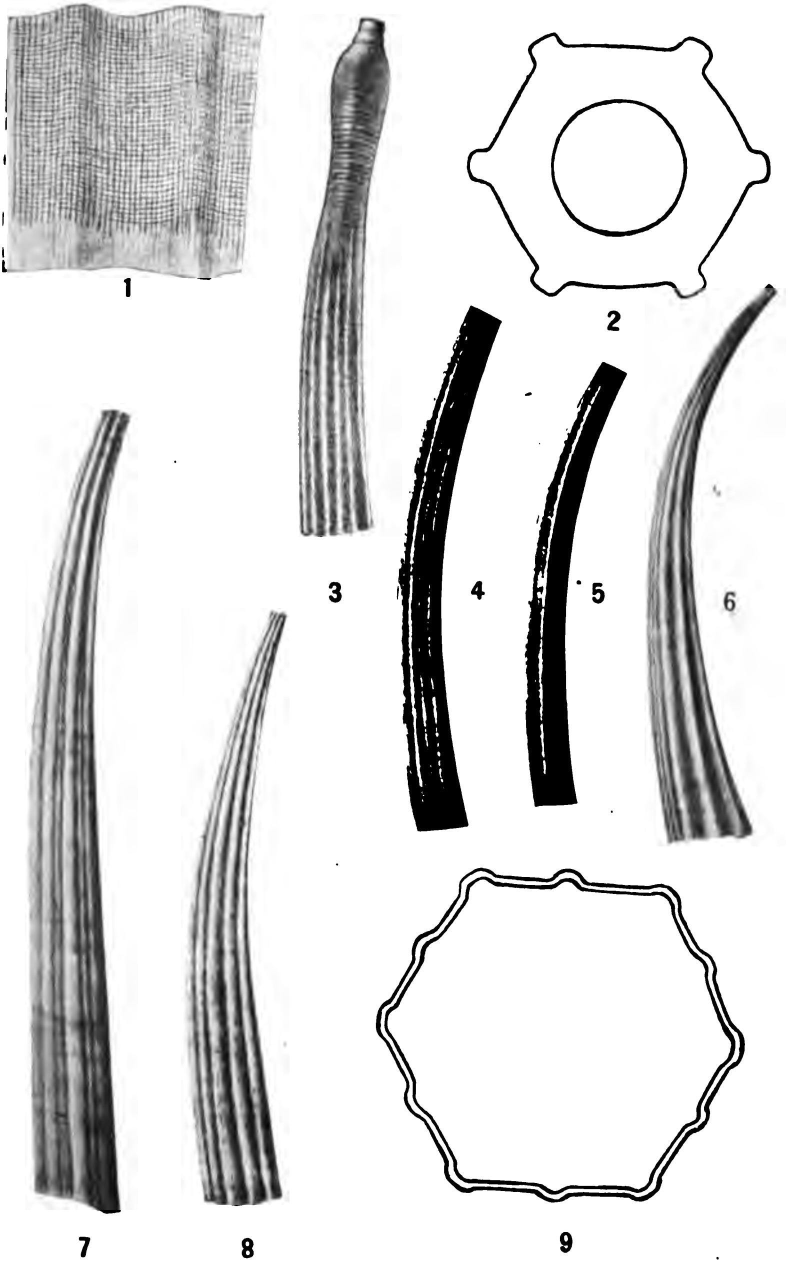

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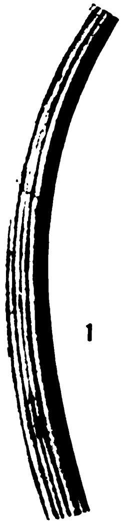
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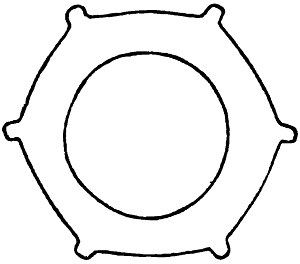
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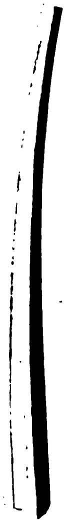
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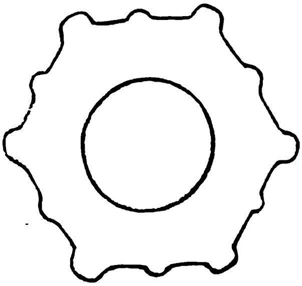
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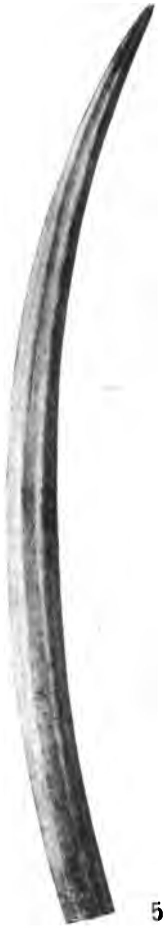
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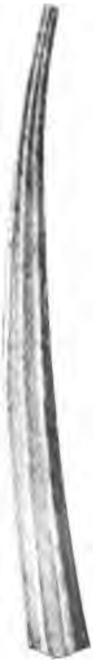
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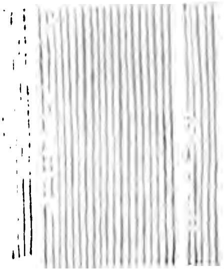
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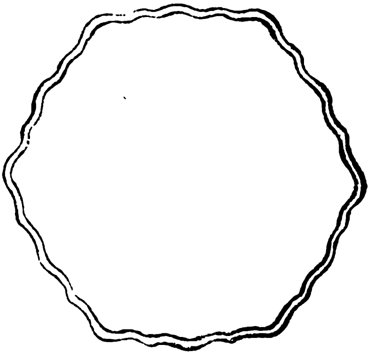
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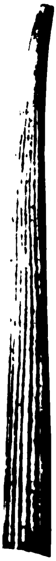
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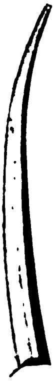
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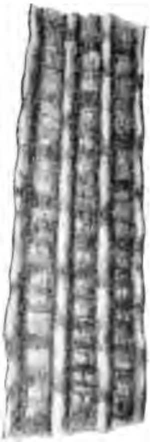
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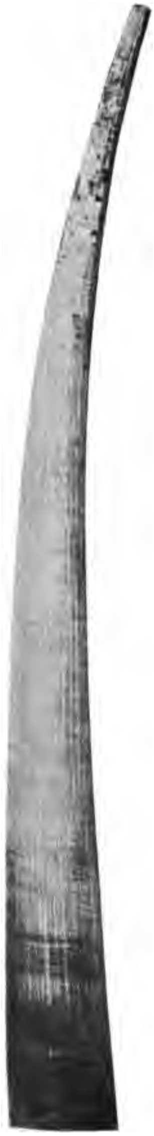
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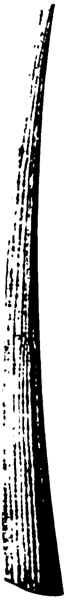
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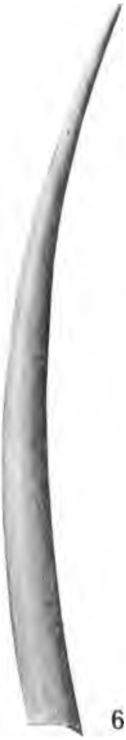
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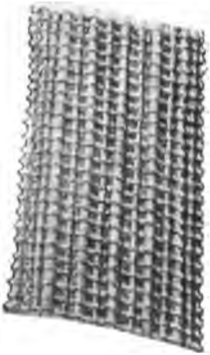
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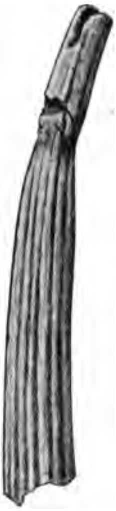

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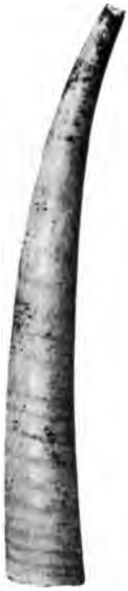

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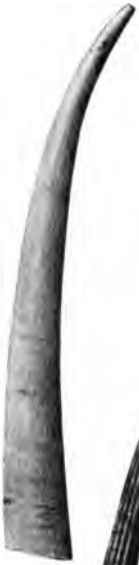

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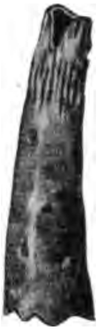

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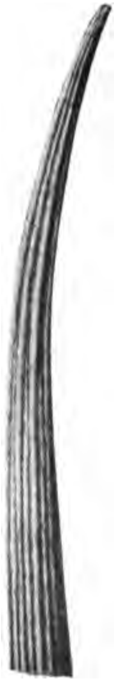

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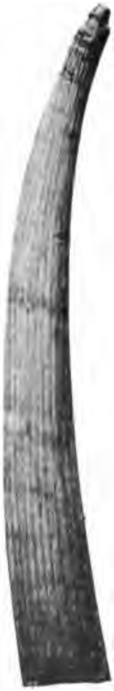

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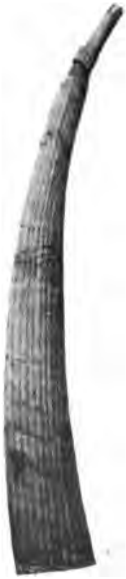

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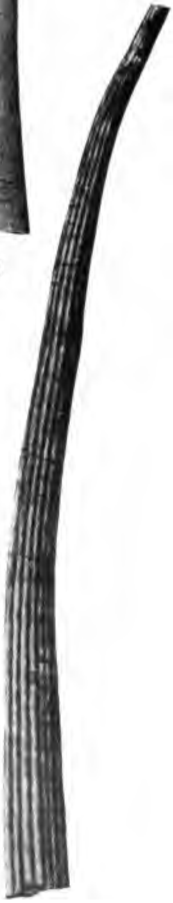

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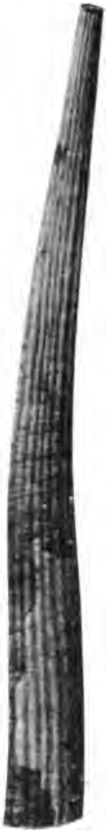

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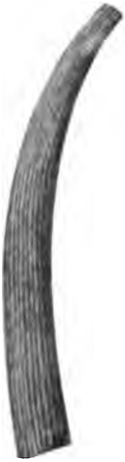

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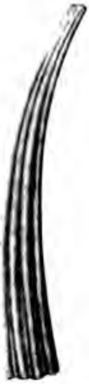

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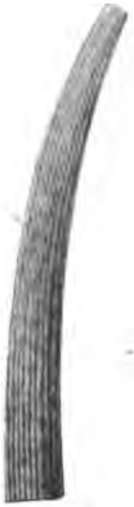

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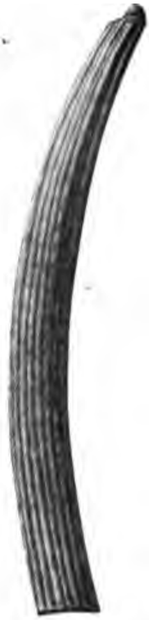

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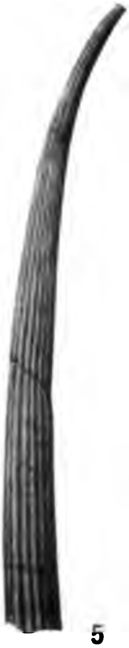

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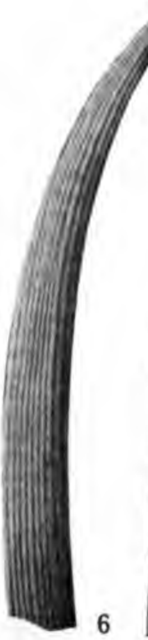

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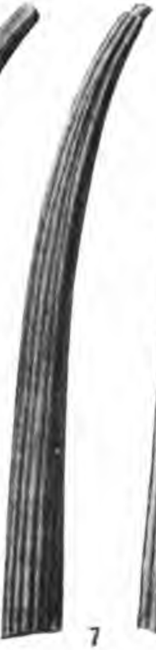

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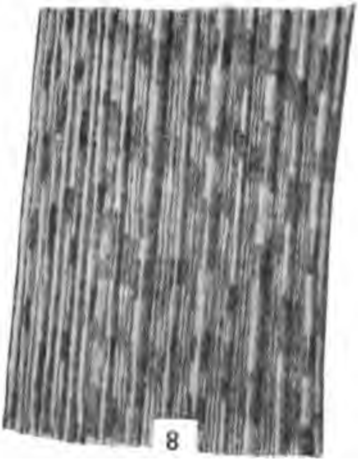

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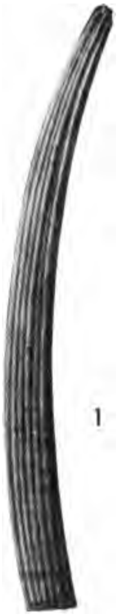

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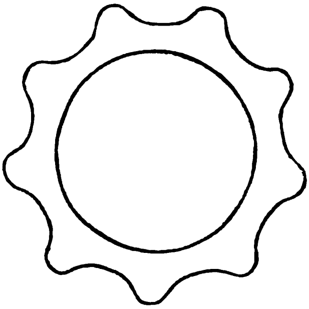

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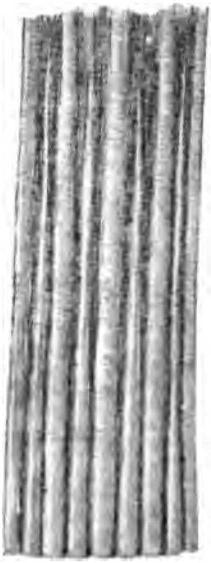

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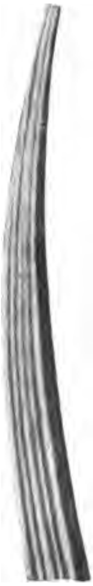

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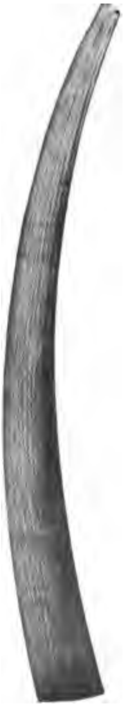

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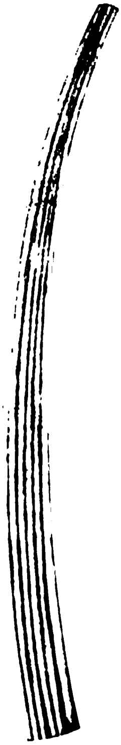

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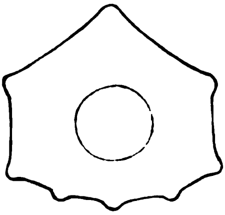

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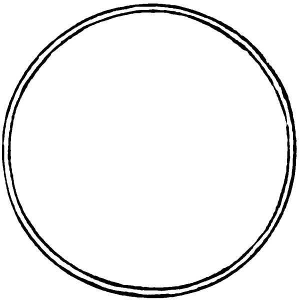

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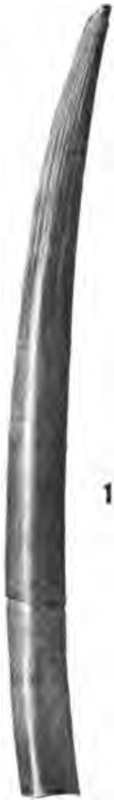
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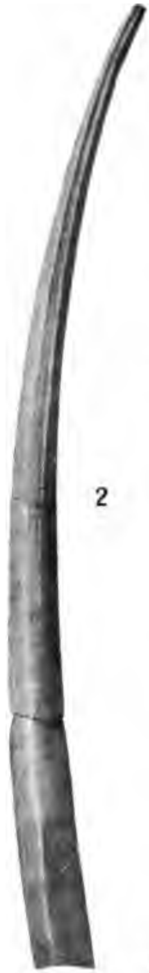
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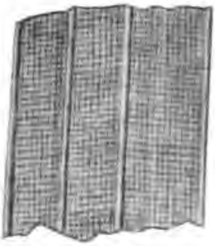
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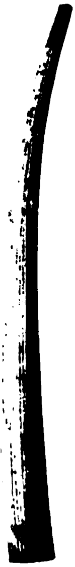
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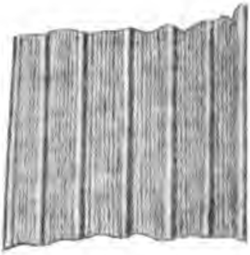
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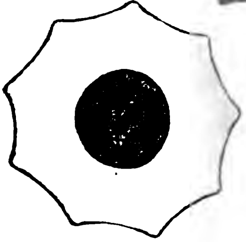
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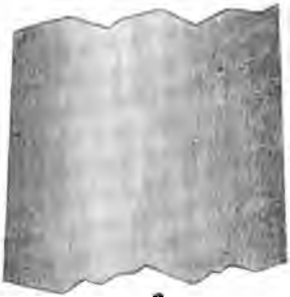
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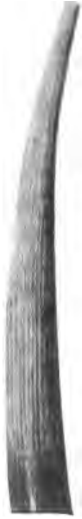
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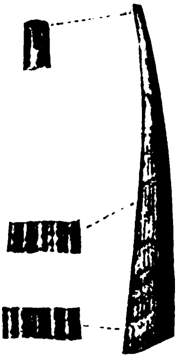

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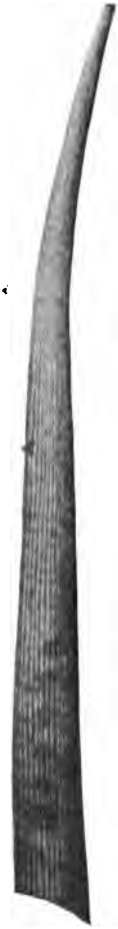

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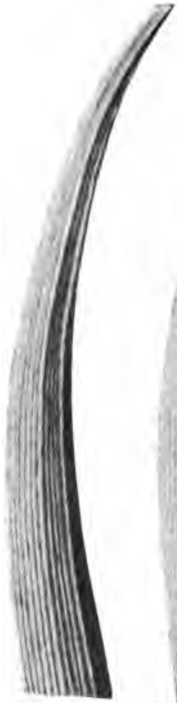

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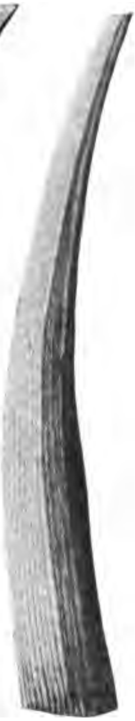

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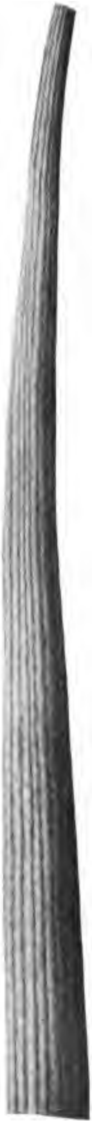

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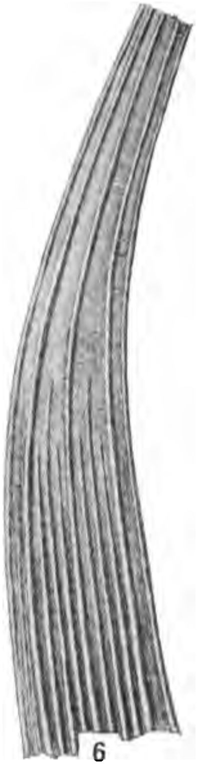

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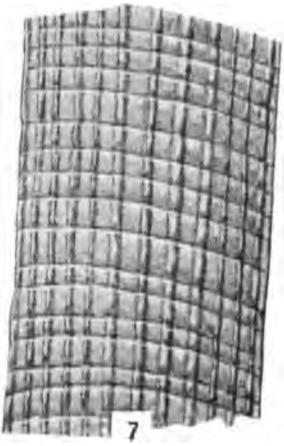

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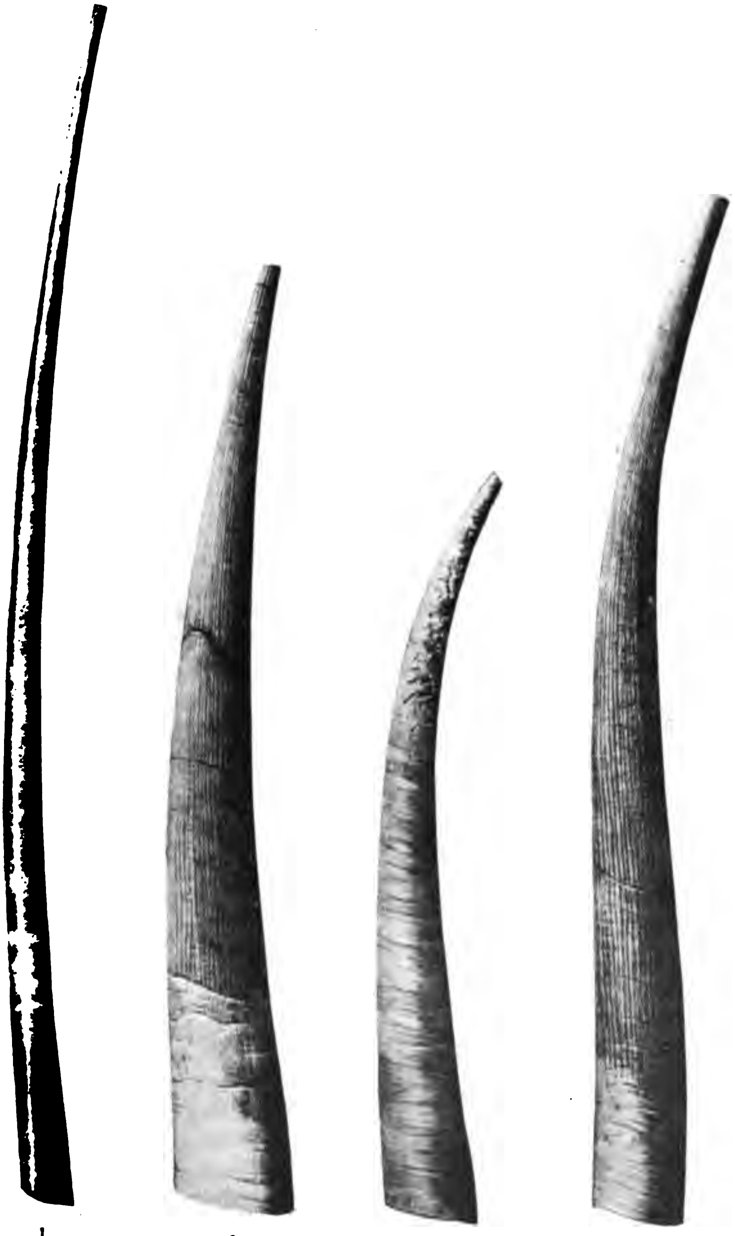

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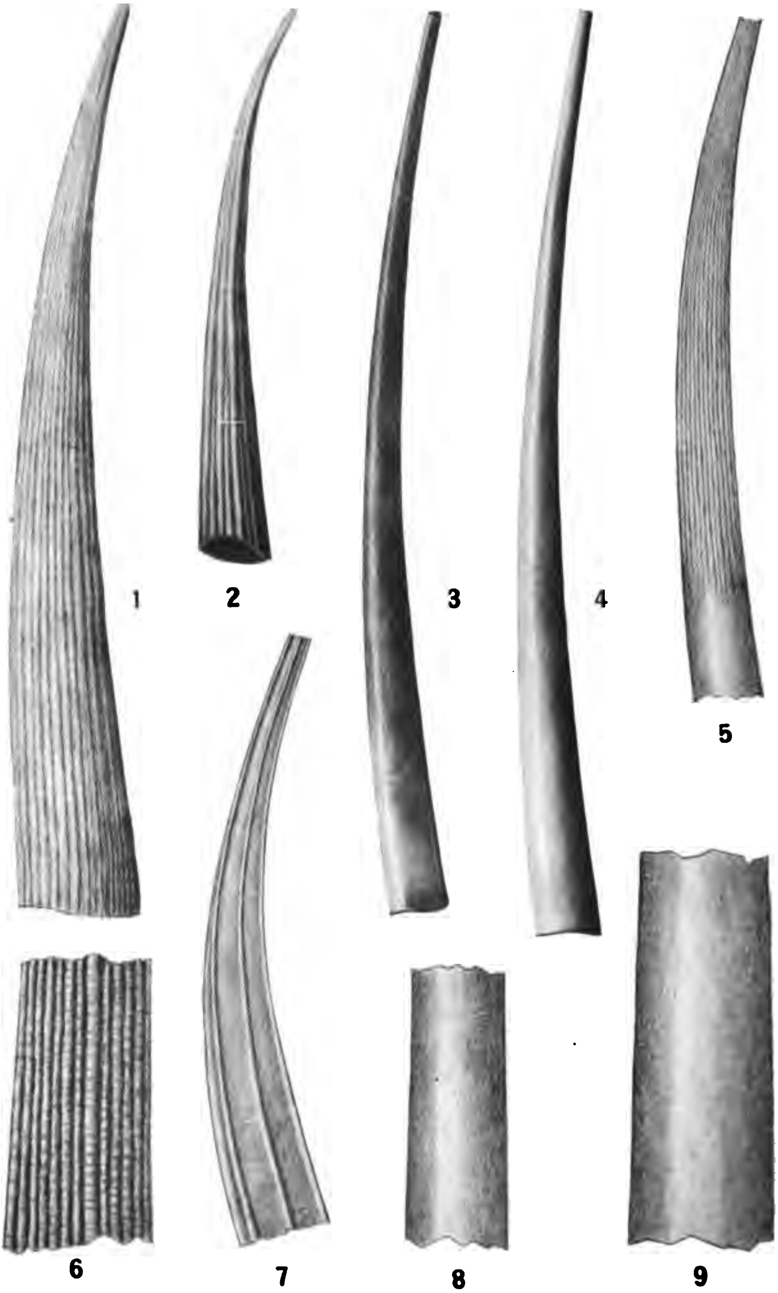

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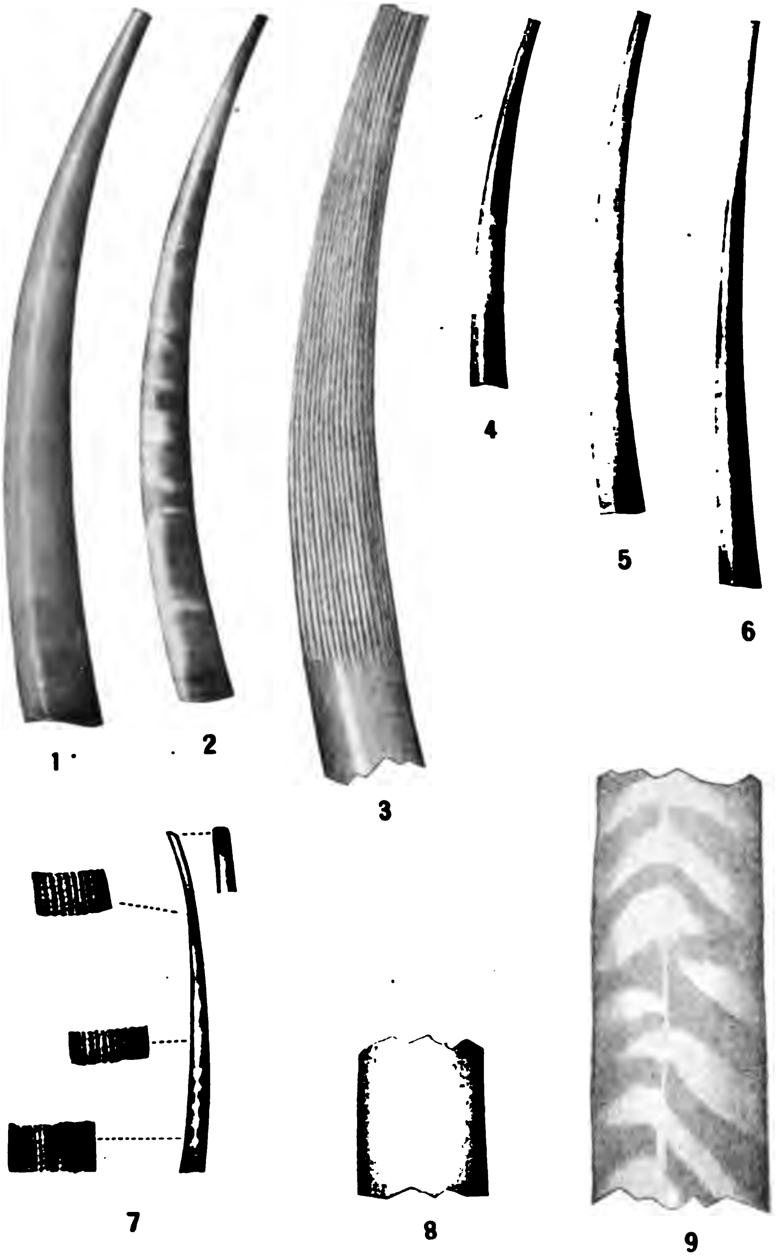

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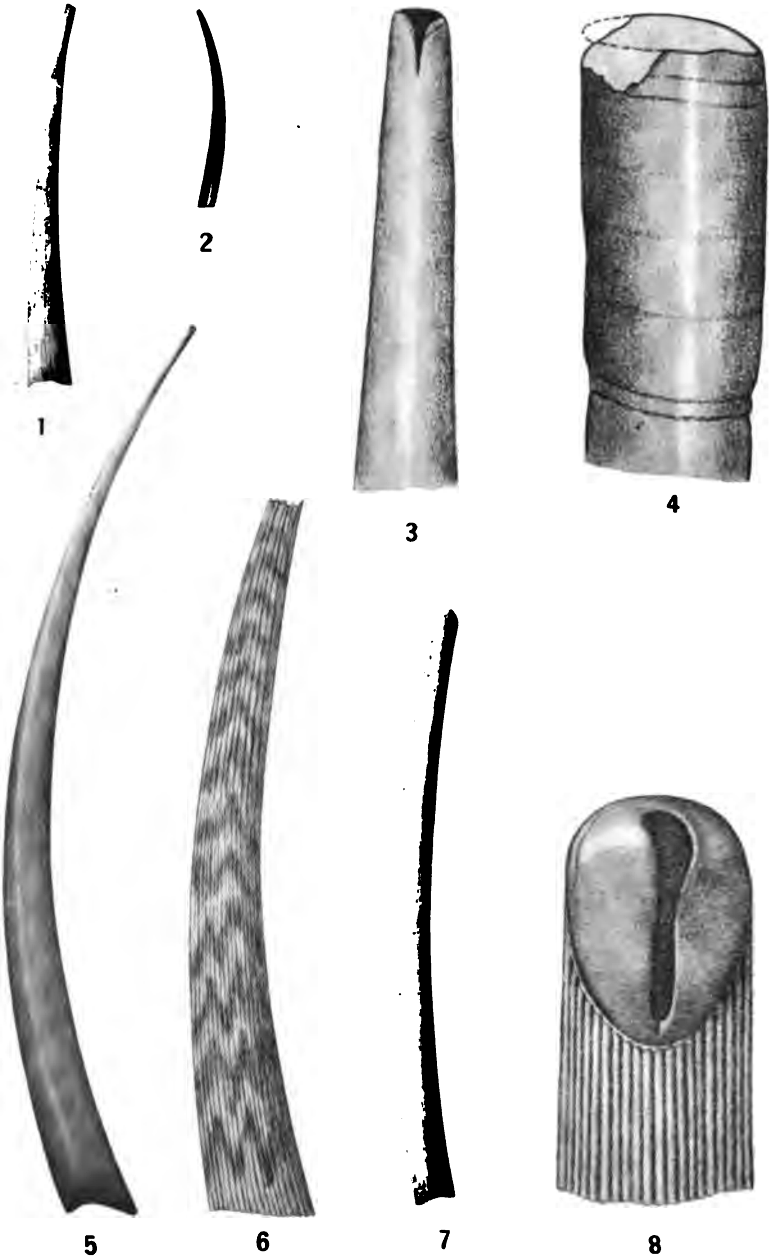

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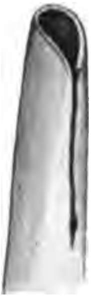
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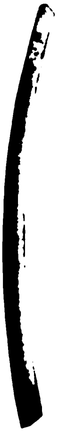
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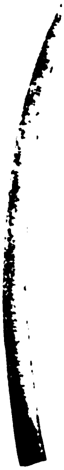
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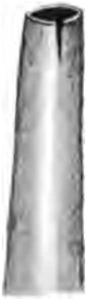
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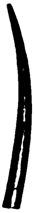
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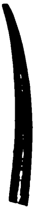
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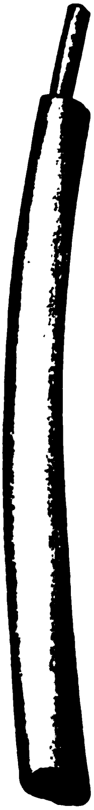
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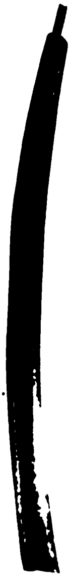
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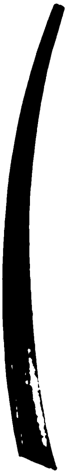
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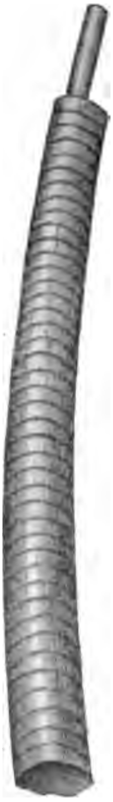
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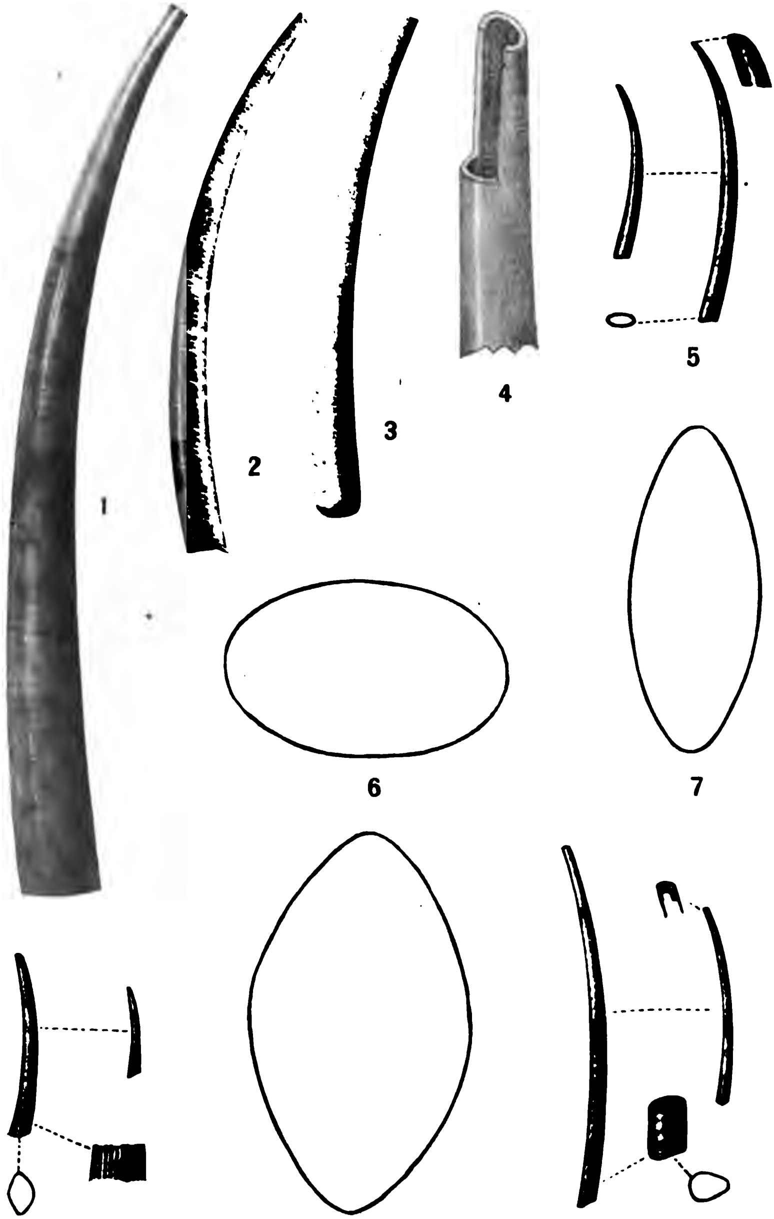

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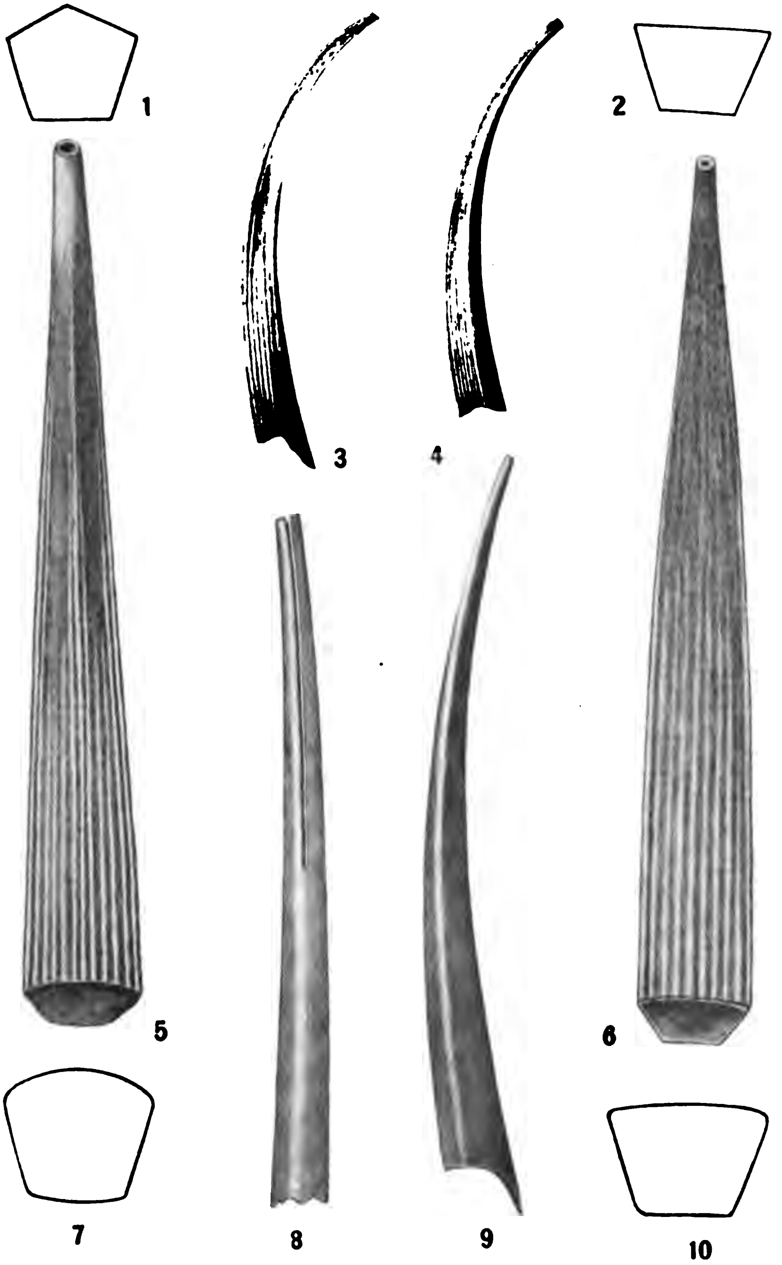

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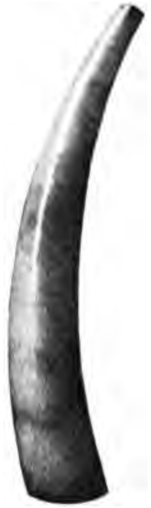

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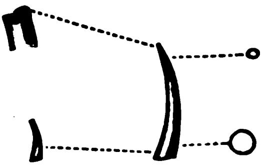

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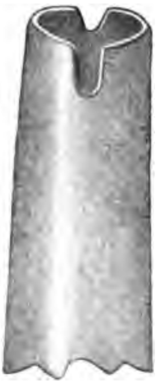

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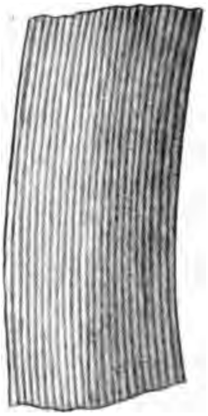

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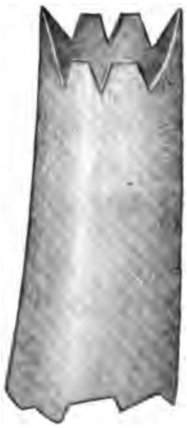

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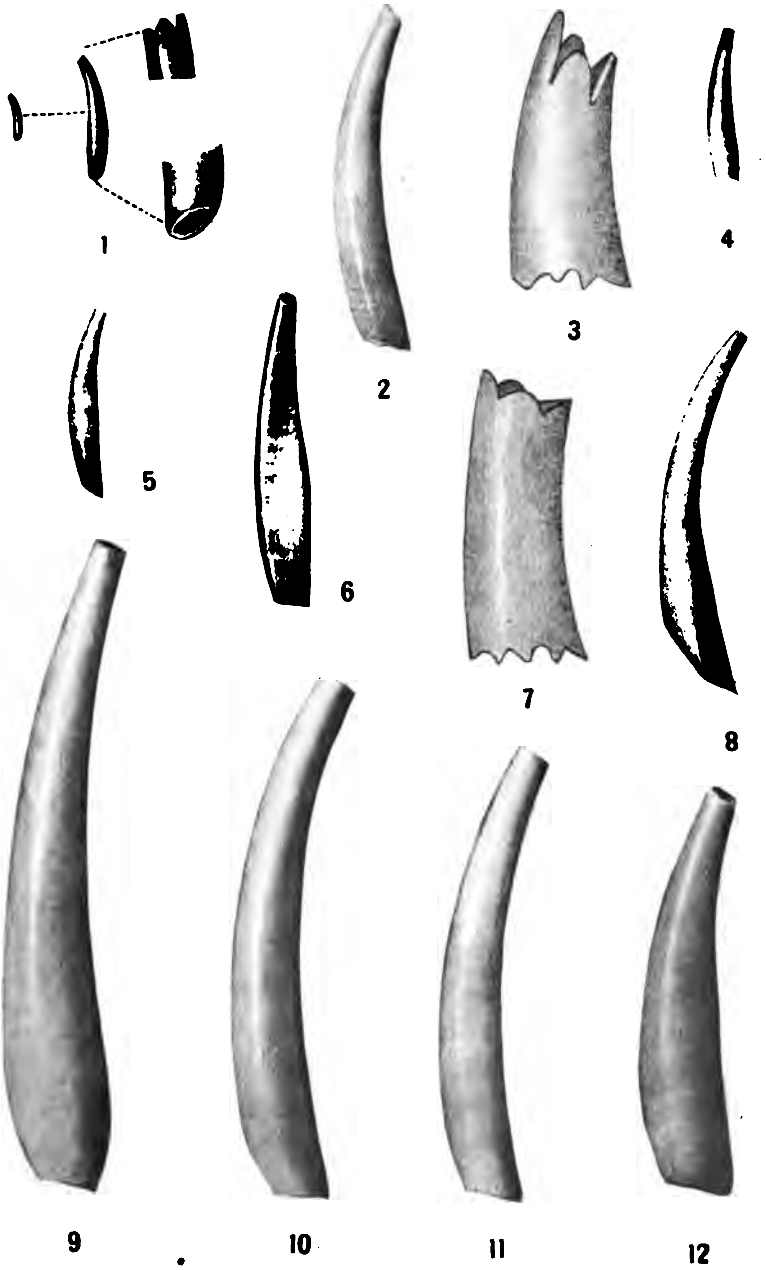

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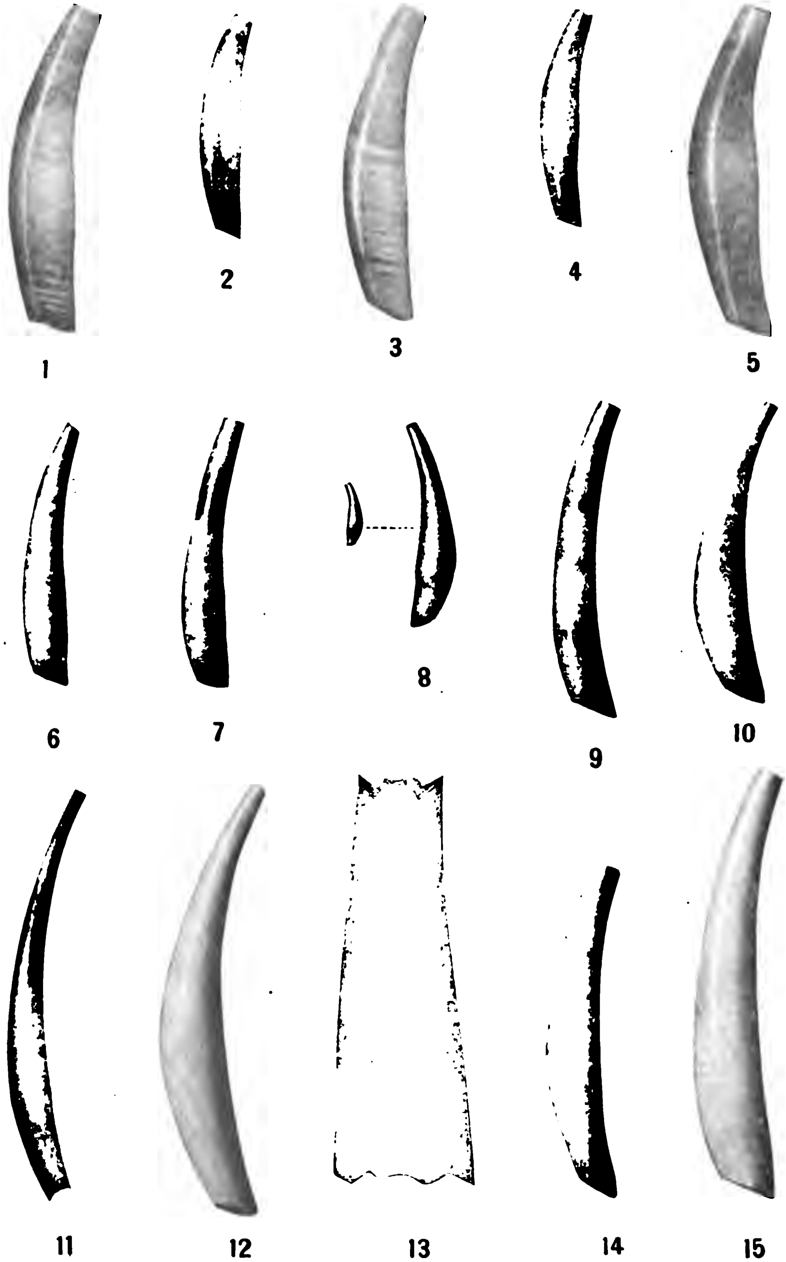

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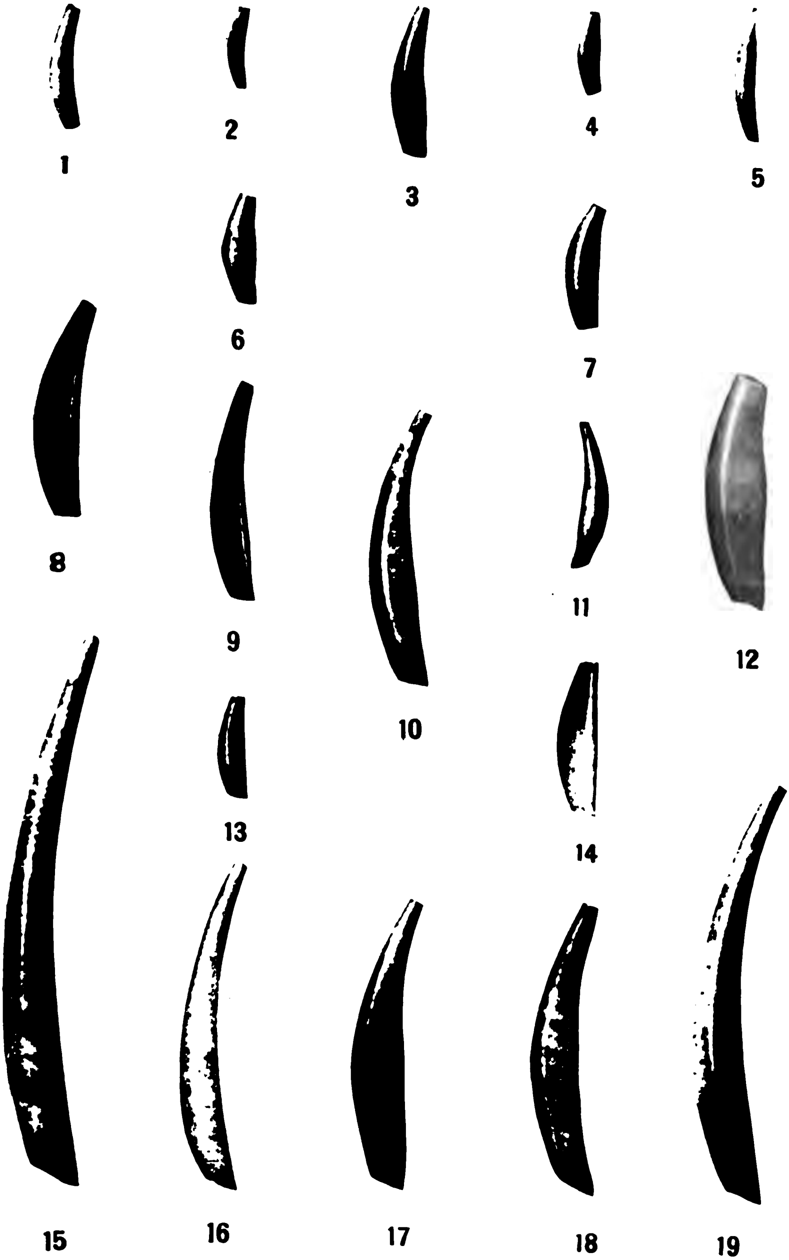

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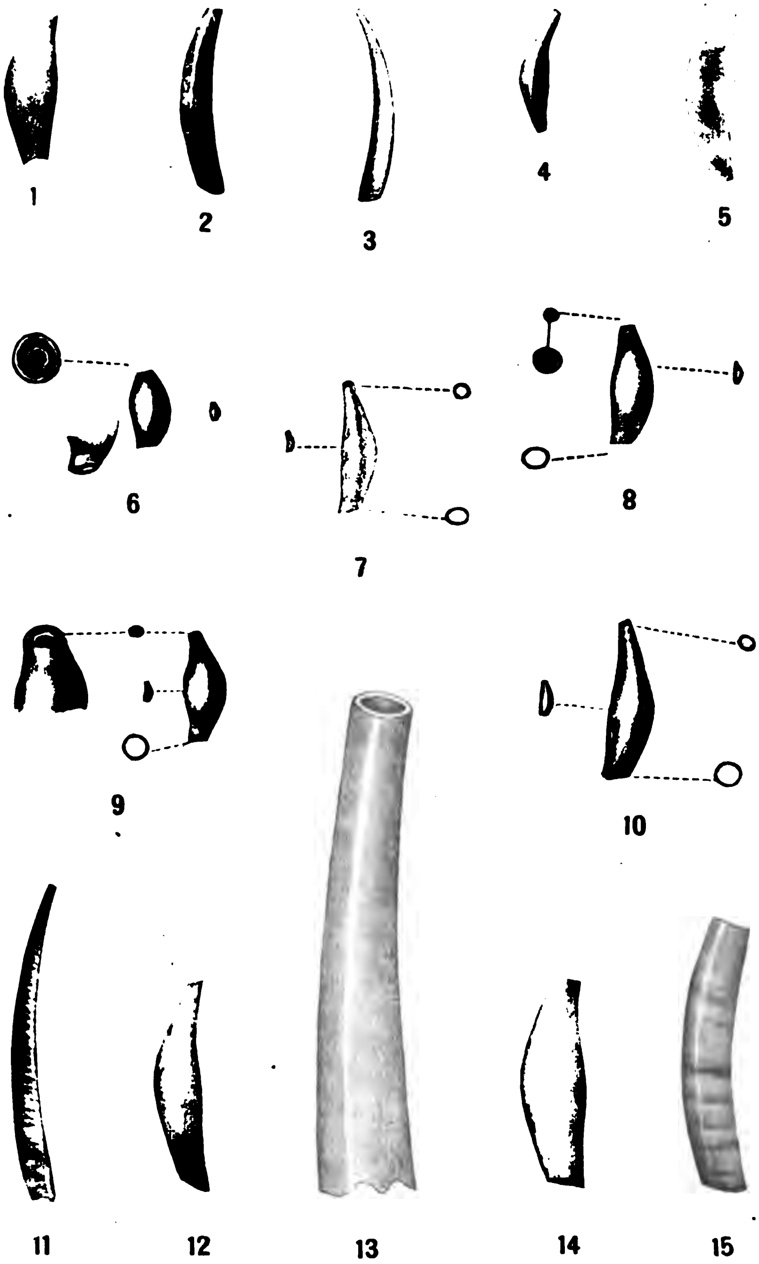

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SUMMARY OF THE MARINE SHELLBEARING MOLLUSKS OF THE NORTHWEST COAST OF AMERICA, FROM SAN DIEGO, CALIFORNIA, TO THE POLAR SEA, MOSTLY CONTAINED IN THE COLLECTION OF THE UNITED STATES NATIONAL MUSEUM, WITH ILLUSTRATIONS OF HITHERTO UNFIGURED SPECIES

BY

WILLIAM HEALEY DALL
Honorary Curator of Mollusks, United States National Museum

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The *Proceedings*, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original, and usually brief, papers based on the collections of the National Museum, presenting newly acquired facts in zoology, geology, and anthropology, including descriptions of new forms of animals, and revisions of limited groups. One or two volumes are issued annually and distributed to libraries and scientific organizations. A limited number of copies of each paper in pamphlet form, is distributed to specialists and other interested in the different subjects as soon as printed. The date of publication is printed on each paper, and these dates are also recorded in the tables of contents of the volumes.

The *Bulletins*, the first of which was issued in 1875, consist of a series of separate publications comprising chiefly monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal .works, reports of expeditions, and catalogues of type specimens, special collections, etc. The majority of the volumes are octavos, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable.

Since 1902 a series of octavo volumes containing papers relating to the botanical collections of the Museum, and known as the *Contributions from the National Herbarium*, has been published as bulletins.

The present work forms No. 112 of the *Bulletin* series.

William de C. Ravenel,
Administrative Assistant to the Secretary,
in charge of the United States National Museum.

Washington, D. C., November 5, 1920.

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SUMMARY OF THE MARINE SHELLBEARING MOLLUSKS OF THE NORTHWEST COAST OF AMERICA, FROM SAN DIEGO, CALIFORNIA, TO THE POLAR SEA, MOSTLY CONTAINED IN THE COLLECTION OF THE UNITED STATES NATIONAL MUSEUM, WITH ILLUSTRATIONS OF HITHERTO UNFIGURED SPECIES.

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INTRODUCTION.

To the preparation of this summary the author has brought the results of more than 50 years' study of the molluscan fauna of the northwest coast, his personal investigations in the field having begun in 1865, when, under the auspices of the Smithsonian Institution, he visited the shores of the Pacific as a member of the scientific corps of the Western Union Telegraph Expedition.

Since that time a constant inflow of material from that region has enriched the collection of the United States National Museum until it has become unrivaled in this group of animals.

Very few of the species described from the area between the southern boundary of the United States and the Polar Sea on the Pacific coast are absent from the series referred to. In a few cases where the writer has not been able to verify personally the names or the distribution from authentic specimens, the name of the authority upon whom the data rest has been added in parentheses.

The distribution of the Mollusca on the west coast of America may be allotted to three grand divisions: the Arctic or Boreal, the Temperate, and the Tropical faunas.

The first, containing many Circumboreal species, extends from the Arctic or Polar Sea to the southern limit of drift ice in winter in Bering Sea.

The Temperate division extends from this line southward on the west coast of America to Point Conception, California.

The Tropic division extends from this point southward to Point Aguja on the coast of Peru.

Each of these divisions may be subdivided into subordinate and reasonably distinct faunas; the Arctic into Eastern and Western, or

Atlantic and Pacific; the Temperate into Aleutian, Oregonian, and Californian; the Tropic into Gulf of Californian, Panamic, and Ecuadorian. These divisions coincide with differences of temperature of the sea water, generally indicated by the distribution of ocean currents.

Taking the distribution of a single family these distinctions might have their boundaries somewhat modified, but on the average of the whole molluscan fauna they appear to be well established.

The limits of these faunas are not in all cases sharply defined. Some of the less sensitive species will be found to range far beyond the divisional boundaries. In southeastern Alaska, where the inshore channels of the Alexander Archipelago are kept cold by the drainage from glacier streams, many Arctic forms persist; perhaps relicts from the glacial period; while on the outer fringe of the islands quite a number of the more southern species extend their range northward in the warmer ocean waters.

The student of this list will notice many more species, which from southern California extend their range to Panama or even Peru, than are recorded in any previous publication.

There is a special faunula existing on the shallow plateau of northeastern Bering Sea. It is composed largely of carnivorous gastropods, which do not approach the shores. This has furnished a multitude of Buccinidae to the present summary, and was, before the incursion of the whaling fleet, the summer feeding ground of vast numbers of the Pacific walrus.

Before concluding this introduction it would be improper to omit a few words of gratitude to the numerous private students and collectors whose investigations and contributions to the collection have added a multitude of new forms to the known fauna, and to whom a large part of such completeness as this summary may possess is necessarily due. Detailed acknowledgments must await another occasion, but the evidence of their activities is on permanent record in the collections of the United States National Museum, and will afford to future students an indispensable basis for study.

Acknowledgment must also be made to the Director of the United States Geological Survey for the opportunity afforded me to work upon and publish the present paper.

In indicating a figure illustrative of the species standard works, such as are generally accessible in large libraries, have been chosen when possible. If the figure in the work referred to bears there a different specific designation from the one here adopted, it may be understood that the former name is a synonym of the one used in this summary, or for some other reason is not accepted.

Every effort to keep the classification adopted as up to date as possible has been made; though this is a subject on which differences of opinion are to be expected. The International rules of nomenclature have been rigidly followed, in the belief that the progress of science depends largely on standardization of names, however painful it is to note the disappearance of familiar but erroneous designations. The accuracy called for by the present state of the science should not be relaxed to satisfy the protests of amateurs in taxonomy.

In compiling this list I have taken advantage of the work of my colleague, Dr. Paul Bartsch, who has with great care and intense microscopical study worked out the species of minute forms, such as the Pyramidellidae, Rissoidae, Synceratidae, and Caecidae, and have adopted his results as published in the Proceedings of the United States National Museum during the last few years, with only such changes as the progress of science since their publication has made advisable. Many forms which on a superficial examination by the older authors were regarded as mere mutations of a single species have proved on microscopic study to possess constant characters fully entitling them to specific rank. In general, whenever the characters seem to justify it, I have preferred to record separately forms which, on the examination of only a few specimens, might have been regarded as mere mutations. By thus separating them, often from examination of a multitude of individuals, attention is called to their characters, and future students will have an opportunity to exercise their judgment on the question of specific distinction when otherwise it might have been entirely overlooked.

Many of the species with a wide geographical range follow the isotherms, and when collected in the north appear to be denizens of moderate depths, but in the southern part of their range are found only at great depths where the temperature of the water is the same as in their more boreal habitat. It becomes difficult therefore to determine which species are really members of the archibenthal fauna. I have in the following discussion regarded only those found exclusively in depths of over 200 fathoms as belonging to that fauna, and therefore the number of species of that group in the table may seem unduly small, for many of the others also reach great depths in part of their range.

A very few exceptional cases occur where species are known from deep water in the northern part of their range yet have been obtained in moderate depths in the south. Transportation and regurgitation by fishes may account for this anomaly which must await more thorough collection of living specimens for explanation.

In certain cases of anomalous distribution reported by collectors, and when I have not examined personally authentic specimens, I have appended the name of the authority for the locality. A former habit of the Spanish women of southern California, of preparing shell work for sale to tourists and of carrying their baskets of shells (often from Mexican localities) when they went collecting on California beaches, and sometimes spilling a few to be picked up later by other collectors, is responsible for some early records which with better knowledge seem adventitious. The Monterey beaches furnished several records of this kind to Gabb and Cooper, which I have rejected as doubtful. Another source of error arose from the small vessels which used to cruise in the Gulf of California and on the Mexican coast, and which arriving at their home ports in California were beached to scrape off accumulated seaweed, barnacles, etc., containing a certain number of southern mollusks and brachiopods, which, however, never seem to become acclimated. San Diego has furnished some records which may be attributed to this cause. However, eliminating such sources of error, the collections in the United States National Museum upon which this list is primarily based, show a much larger proportion of species ranging from Point Conception to the Gulf of California, Mexico, and Panama than was thought possible by Carpenter and other early students of the West Coast faunas.

In endeavoring to assort according to their respective faunas the species in the following discussion I have met with the difficulty of properly placing a number of species which overlap the limits of one or more faunal districts in their geographic range. In such cases I have tried to assign them to the fauna which seemed to be their natural center of distribution. Probably no two persons would agree exactly with all such decisions, but there seems to be no way to avoid this difficulty.

Excluding the Cephalopoda and Nudibranchiata which I have left for treatment by those more expert in those special groups, and adding a few species which have come to my notice among the bivalves since the publication of my check list of the Pelecypoda, I find the census giving the following results for the region included:

Pelecypoda	496	Gastropoda s. s.	1,424
Scaphopoda	19	Polyplacophora	134
Pteropoda	20	Aplacophora	16
Heteropoda	13		
		Total species	2,122

Geographically distributed as follows:

Species introduced with "seed" oysters	6
Pelagic species	28
Exclusively abyssal species	151
Arctic species	148
Species of the Aleutian subfauna	291
Species of the Oregonian fauna	371
Species of the Californian fauna	996
Species of the Panamic fauna	131
Total species	2,122

The latest previous list for the region, that of Carpenter, enumerates 468 species. Of the fauna as now enumerated, 136 forms are common to the Atlantic waters, nearly all belonging to the Arctic seas. There are a few species from the western part of Bering Sea which might more properly be assigned to the Okhotsk or Asiatic fauna, which is generally quite distinct from that of the American shores, but I have thought it best to include them as they may extend to the western Aleutians. The plateau fauna of the shallow part of Bering Sea, which is also in the main distinct from that of the surrounding coasts, has not been segregated from the Aleutian group owing to the fact that thorough collections have not been made, and in the present state of our knowledge it is impossible to be certain how many and which species are exclusively confined to the plateau group, which consists largely of Buccinidae.

The fauna of Kamchatka and the Okhotsk Sea, besides a large number of endemic species, contains many analogues of forms peculiar to the American coast, but specifically distinct from the latter. This is probably due to the chasm of deep water extending from the area between the end of the Aleutian chain and the Russian possessions. This abyss extends northward east of the Commander Islands almost to Bering Strait, heading near the entrance to Plover Bay on the Siberian side. The separation of the two areas has apparently existed long enough for the modification of the American and Okhotsk faunas to specific differences in many originally identical forms.

We find also a certain number of species still persisting in the region of North Japan, the Kuril Islands, and southern Kamchatka, which are also found in the Oregonian and northern California faunas, but not in the Aleutian region between their present habitats. These are probably relics of the time when warmer seas extended to the north and a gradual refrigeration exterminated them in the intervening area. Such a species is *Haliotis kamchatkana.*

The Tertiary and Pleistocene fossils of the shores of Bering Sea also bear evidence of a communication with Atlantic waters during the prevalence of more genial conditions. Several species now living in Bering Sea are found fossil in the late Pliocene of Sankoty Head, Nantucket, and the Pliocene of Iceland, and conversely the common periwinkle of New England, *Littorina palliata* Say, is one of the species found in the elevated beaches of the Nome district, Alaska, and now extinct on the Pacific side. Evidently the intercommunication must have been tolerably free between the two oceans at the time, though now there are quite pronounced differences between the Greenlandic and the Bering Strait Arctic assemblies of mollusks.

A few Mediterranean forms such as *Gibbula adriatica* and *Cymatium corrugatum* appear in the Californian fauna, but no plausible explanation of their presence occurs to me.

Certain discrepancies between the groups of mollusks both in deep and shallow water on the two sides of America were pointed out by me in the discussion of the data in my reports on the dredgings of the *Blake* and *Albatross*. For instance the profusion of species of the Marginellidae in West Indian waters and their scarcity on the Pacific side. Some genera are found only fossil on the Atlantic shores, such as *Strombina*, *Harpa*, and *Cymia*, but are well represented by living forms in the Pacific. Again note the profusion of *Haliotis* on the shores of the Pacific with only a single depauperate deep water species in the western Atlantic. The great number of Pacific *Tritonalia* and other muricoid species contrasts strongly with their paucity on the opposite shores. The late Dr. Philip Carpenter used to lament the absence on the Atlantic coast of the myriads of minute Gastropods he was accustomed to collect on British hunting grounds. That the difference is real, is proved by the scanty rewards which have fallen to New England collectors. But no such scarcity would have been noted had Doctor Carpenter been a west coast collector.

These singularities of distribution will doubtless find an explanation when the recent and fossil mollusk faunas of the two areas are more thoroughly known. At present, hypotheses must be regarded as premature.

A few remarks on the classification adopted may be in order. Of late years some specialists on particular groups, having small knowledge of any but their own particular field, have naturally exaggerated the importance in a classificatory sense of certain features of the subjects of their studies. Two or three bristles in a particular place have sufficed to establish a dipteran genus. This sort of taxonomy does not appeal to me and I have, except in extremely populous groups where convenience requires more laxity, endeavored to exercise a reasonable conservatism in the adoption of divisional names of higher rank than species. I have preferred to utilize the subgeneric names in groups containing numerous species because it familiarizes the student with the subdivisions which in many cases will doubtless reach generic rank at some future time under more intensive study than is at present practicable. Also because of the greater convenience in handling populous groups. In the case of species and varieties, I have preferred inclusiveness to lumping in all cases where doubt existed, but I have not included names based upon mutational color patterns except when the differences are so marked as to be a possible source of misunderstanding to the inexperienced student. In many groups these differences are due to food, or peculiarity of situs, as in *Crepidula*, *Haliotis*, *Acmaea*, and other sessile forms. They are not true species, but further investigation is required to establish the source of their differences. A list of this kind is the basis for improvements, additions, and corrections, and such changes are to be taken as inevitable and welcome. For errors such as are almost impossible to exclude in work depending on such multitudinous and scattered data, those who have undertaken similar work will be most charitable. Naturally the utmost care has been taken to avoid them.

The Pteropods are now known to exist (by the almost miraculous preservation of the characters of the soft parts) in material from the Middle Cambrian collected by Walcott. The absurdity of deriving them from the Opisthobranch forms which first occur in Mesozoic faunas, is so obvious as to require no argument.

That the embryonic form of some Aplacophora possesses temporarily eight dorsal plates, indicates their place as extremely degenerate Chitonoids. It is my opinion that the characters allying the Amphineura to the more evolved forms of Gastropoda have greater taxonomic value than those relied upon to separate the former with the rank of a class, in spite of the different decision arrived at by some much respected authors. I have therefore restricted them to the rank of subclass, assigning ordinal rank to the two groups Polyplacophora and Aplacophora. I am indebted to Prof. Harold Heath's discussion and classification of the west coast Aplacophora for that part of the list.

The material upon which the present list is based is almost exclusively contained in the collection of the United States National Museum and is the result of more than half a century of collecting, beginning with the United States Exploring Expedition material studied by Dr. A. A. Gould. Among the earlier collectors should be named Dr. William Stimpson of the Ringgold and Rodgers exploring expedition; Major William Rich and Colonel Ezekiel Jewett of the Mexican War naturalists; Caleb Kennerly of the Northwestern Boundary Survey; the Rev. Joseph Rowell, an early Californian missionary; William M. Gabb and J. G. Cooper of the Geological Survey of California; Thomas Bridges, William P. Blake, and R. E. C. Stearns. Of those mentioned most of the types of species described by them, or by others from their collections, are preserved in the national collection. Of the collections made on the *Albatross* voyages and by the officers of the United States Revenue Marine and by the United States Bureau of Fisheries, beside my own collections made from 1865 to the end of the nineteenth century while in the service of the Western Union Telegraph Expedition, the United States Coast and Geodetic Survey, and the United States Geological Survey, the types are preserved in the same custody.

The above list refers only to the early collectors who have furnished type specimens to the collection. To the many later private collectors who have wisely and generously contributed material to the United States National Museum I hope to give individual credit in another publication.

There are a few new species on the point of publication which may possibly be delayed until after the issue of this bulletin. I have thought best to include their names, with references to the proposed vehicle of publication, to which the reader may hereafter add the page references when available.

SUMMARY OF SPECIES.

CLASS PELECYPODA.

Order PRIONODESMACEA.

(FOLIOBRANCHIATA)

Superfamily SOLENOMYACEA.

Family SOLEMYACIDAE.

Genus SOLEMYA Lamarck, 1818.

Subgenus Acharax Dall, 1908.

ACHARAX JOHNSONI Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 189; vol. 17, p. 712, pl. 25, fig. 1.
Oregon to Panama.

ACHARAX AGASSIZII Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 365, pl. 16, fig. 10.
Tillamook, Oregon, to Point Aguja, Peru.

Subgenus Petrasma Dall, 1908.

PETRASMA PANAMENSIS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 366.
Santa Barbara, California, to Panama.

PETRASMA VALVULUS Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 312.
San Pedro, California, to Gulf of California.

Superfamily NUCULACEA.

Family NUCULIDAE.

Genus NUCULA Lamarck, 1799.

NUCULA TENUIS Montagu, 1808.
Test. Brit. Suppl., p. 56, pl. 29, fig. 1.—Hanley, Mon. Nuculidae, pl. 4, figs. 140, 141.
Point Barrow to Coronado Islands. Circumboreal.

NUCULA TENUIS EXPANSA Reeve, 1855.
Last of the Arctic Voy., App., p. 397, pl. 33, fig. 2.
Arctic Ocean to Sitka, Alaska: San Diego?

NUCULA QUIRICA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 394.
Chugachik Bay, Cooks Inlet, Alaska.

NUCULA PETRIOLA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 395.
Off Santa Rosa Island, California, in 53 fathoms.

NUCULA CARDARA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 394.
Monterey, California, to Lower California, in deep water.

NUCULA LINKI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 394.
Queen Charlotte Sound to Guaymas, Mexico.

NUCULA DARELLA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 394.
Off San Diego, in 822 fathoms.

NUCULA.
Bering Sea, 1,401 fathoms.

NUCULA EXIGUA Sowerby, 1832.
Proc. Zool. Soc., p. 198.—HANLEY, Mon. Nuculidae, pl. 4, fig. 130.
Golden Gate to Acapulco.

NUCULA CARLOTTENSIS Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 6, pl. 1, figs. 15, 16.
Queen Charlotte Islands to Anacapa Island.

Subgenus ACILA H. and A. Adams, 1858.

ACILA CASTRENSIS Hinds, 1843.
Proc. Zool. Soc., p. 98.—HANLEY, Mon. Nuculidae, pl. 5, fig. 148.
Bering Sea to San Diego, California.

Family LEDIDAE.

Genus LEDA Schumacher, 1817.

LEDA TAPHRIA Dall, 1897.
Bull. Nat. Soc. Hist. Brit. Col., No. 2, p. 7, pl. 2, figs. 6, 8.
Bodega Bay, California, to Lower California.

LEDA CELLULITA Dall, 1896.
Nautilus, vol. 10, No. 1, p. 1; Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 7, pl. 2, figs. 5, 7.
Puget Sound.

LEDA ACUTA Conrad, 1831.
Amer. Mar. Conch., p. 32, pl. 6, fig. 1.
Nazan Bay, Atka Island, Aleutians, to Gulf of California.

LEDA MINUTA, Fabricius, 1776.
Fauna Grönl., p. 414.—HANLEY, Mon. Nuculidae, pl. 3, figs. 61, 62.
Arctic Ocean to San Diego, California. Also Atlantic.

LEDA MINUTA LOMAËNSIS Dall, 1919.
Proc. Biol. Soc., Wash., vol. 32, p. 249.
San Diego, California.

LEDA NAVISA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 395.
Farallones Islands to San Diego, California.

LEDA AMIATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 395.
Off San Diego, in 488 fathoms.

LEDA PENDERI Dall, 1910.
Canada Geol. Surv. Mem. 14 N., No. 1143, p. 9, pl. 1, figs. 3, 4.
Queen Charlotte Islands, to Santa Barbara Islands.

LEDA BUCCATA Steenstrup, 1842.
Moller, Index Moll. Grönl., p. 17.—Hanley, Mon. Nuculidae, pl. 3, figs. 63, 64.
Arctic Ocean and Bering Strait. Also Atlantic.

LEDA HAMATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 98; Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 558, pl. 40, fig. 9.
Puget Sound to Panama Bay.

LEDA HAMATA LIMATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 397.
Santa Barbara to San Diego, California.

LEDA OXIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 395.
Santa Rosa Island, California, to Gulf of California.

LEDA LIOGONA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 396.
Bering Sea in 1,401 fathoms.

LEDA PERNULA Müller, 1779.
Besch. Ges. Naturf. Freunde zu Berlin, vol. 4, p. 55.—Hanley, Mon. Nuculidae, pl. 3, figs. 56, 58.
Arctic Ocean to Plover Bay. Also Atlantic.

LEDA RADIATA Krause, 1885.
Arch. f. Naturg., vol. 51, Heft 1, p. 23, pl. 3, figs. 2 *a–c*.
Arctic Ocean; Plover Bay, Eastern Siberia; Okhotsk and Bering Seas.

LEDA FOSSA Baird, 1863.
Proc. Zool. Soc., p. 71; Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 7, pl. 2, figs. 3, 13.
Kotzebue Sound, Alaska, to Puget Sound.

LEDA FOSSA SCULPTA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 396.
South of Alaska Peninsula, 69 fathoms.

LEDA FOSSA VAGINATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 396.
Kasaan Bay, Alaska, 50 fathoms.

LEDA FOSSA CURTULOSA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 396.
Bering Sea and Unalaska.

LEDA PONTONIA Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 257, pl. 13, fig. 5*b*.
Santa Barbara Islands, California, to Peru and the Galapagos Islands, in deep water.

LEDA LEONINA Dall, 1896.
Nautilus, vol. 10, No. 1, p. 2; Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 7, pl. 2, fig. 12.
Straits of Fuca to latitude 36° north.

LEDA AMBLIA Dall, 1905.
Nautilus, vol. 18, No. 11, p. 123.
Monterey Bay, California.

LEDA CONCEPTIONIS Dall, 1896.
Nautilus, vol. 10, No. 1, p. 2; Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 7, pl. 2, fig. 1.
Aleutian Islands to San Diego, California.

LEDA GOMPHOIDEA Dall, 1897.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 396.
Off Tillamook, Oregon, 786 fathoms.

LEDA EXTENUATA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 8, pl. 2, fig. 2.
Off Sitka, Alaska, 1,569 fathoms.

LEDA SPARGANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 397.
Santa Barbara Islands to Point Loma, California.

LEDA FIASCONA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 397.
Off San Diego, California, in 822 fathoms.

LEDA PHENAXIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 397.
Off San Diego, California, in 822 fathoms.

LEDA DALLI Krause, 1885.
Arch. f. Naturg., vol. 51, p. 27, pl. 3, figs. 1 *a–c*.
Unalaska, Aleutian Islands.

Section PORTLANDIA Mörch, 1853.

LEDA GLACIALIS Gray, 1828.
Index Test. Suppl., pl. 2, fig. 6.
Arctic Ocean at Point Barrow. Also Atlantic.

LEDA COLLINSONI Dall, 1919.
Sci. Res. Canadian Arctic Exp., vol. 8, pt. A, p. 19*a*, pl. 2, figs. 3, 4.
Collinson Point, Arctic Coast.

LEDA ARCTICA Gray, 1819.
App. Parry's Voy., p. 241.—HANLEY, Mon Nuculidae, pl. 1, fig. 5.
Point Collinson, Arctic Ocean. Also Atlantic.

Genus YOLDIA Möller, 1842.

Section MEGAYOLDIA Verrill, 1897.

YOLDIA THRACIAEFORMIS Storer, 1838.
Boston Journ. Nat. Hist., vol. 2. p. 122.—Gould, Inv. Mass., p. 97, fig. 66.
Arctic Ocean to Oregon. Also Atlantic.

YOLDIA SECUNDA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 398.
Southeastern Alaska, in deep water.

YOLDIA BERINGIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 399.
Bering Sea to Anacapa Island, California.

YOLDIA MONTEREYENSIS Dall, 1893.
Nautilus, vol. 7, No. 3, p. 29; Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 9, pl. 2, fig. 16.
Chirikoff Island, Alaska, to San Diego, California.

YOLDIA MARTYRIA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 9, pl. 2, fig. 15.
Kasaän Bay, Alaska, to Gulf of California.

YOLDIA VANCOUVERENSIS, Smith, 1880.
Ann. Mag. Nat. Hist., ser. 5, vol. 6, No. 34, p. 289.
Vancouver Island (Smith).

Section YOLDIA, s. s.

YOLDIA MYALIS Couthouy, 1838.
Boston Journ. Nat. Hist., vol. 2, p. 62, pl. 3, fig. 7.
Arctic Ocean to Puget Sound. Also Atlantic.

YOLDIA COOPERI Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 189; Pal. California, vol. 2, pl. 9, fig. 54.
San Francisco Bay to San Diego, California.

YOLDIA LIMATULA Say, 1831.
Amer. Conch., pl. 12.—Hanley, Mon. Nuculidae, pl. 1, fig. 9.
Arctic Ocean to San Diego. Also Atlantic.

Section CNESTERIUM Dall, 1898.

YOLDIA SCISSURATA Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 595.
Arctic Ocean to Gulf of Georgia.

YOLDIA SEMINUDA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 153; Bull. Nat. Hist. Soc. Brit. Col., No. 2. p. 8.
Okhotsk and Bering Seas to Sitka, Alaska.

YOLDIA ENSIFERA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 9, pl. 2, fig. 4.
Southeastern Alaska to San Luis Obispo, California.

YOLDIA ENSIFERA PLENA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 256.
San Diego, California. 80 fathoms.

Section YOLDIELLA Verrill, 1897.

YOLDIA SILIQUA Reeve, 1855.
Last of the Arctic Voy., vol. 2, p. 396, pl. 33, fig. 3.
Norton Sound, Alaska. Also Atlantic.

YOLDIA INTERMEDIA Sars, 1865.
Fos. Dyre. Quatern. period, p. 38, figs. 92, 96.
Bering Strait and Norton Sound. Circumboreal.

YOLDIA ORCIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 399.
Tillamook Bay, Oregon, to San Diego.

YOLDIA SANESIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 399.
Boca de Quadra, Alaska, to Point Conception, California.

YOLDIA OLEACINA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 398.
Arctic Ocean north of Bering Strait.

YOLDIA CAPSA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 400.
Off Tillamook Bay, Oregon, in 786 fathoms.

YOLDIA CECINELLA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 399.
Aleutian Islands to Gulf of California.

Genus PLEURODON Wood, 1840.

Subgenus CYRILLA A. Adams, 1860.

CYRILLA MUNITA (Carpenter) Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 602.
Santa Barbara Islands, to Gulf of California.

Genus MALLETIA Desmoulins, 1832.

MALLETIA TALAMA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 400.
Bering Sea to Oregon.

MALLETIA PACIFICA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 11, pl. 2, fig. 11.
Chignik Bay, Alaska, to Monterey, California.

MALLETIA FABA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 10, pl. 2, fig. 10.
Queen Charlotte Islands, British Columbia, to Lower California.

MALLETIA FIORA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 400.
Off Sitka, Alaska, 1,569 fathoms.

Genus TINDARIA Bellardi, 1875.

TINDARIA CALIFORNICA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 400.
Santa Barbara to San Diego, California.

TINDARIA GIBBSII Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 10, pl. 2, fig. 14.
Queen Charlotte Islands to Coronado Islands.

TINDARIA DICOFANIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 401.
Off San Diego, in 822 fathoms.

TINDARIA CERVOLA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 402.
Off San Diego, California, in 822 fathoms.

TINDARIA BRUNNEA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 401.
Bering Sea to Tillamook, Oregon.

TINDARIA MEXICANA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 389, pl. 17, figs. 11, 14.
San Diego, California, to Acapulco, Mexico, in deep water.

TINDARIA KENNERLYI Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 11, pl. 2, fig. 9.
Off Sitka, Alaska, to Santa Barbara Islands, in deep water.

TINDARIA MARTINIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 401.
Cape San Martin to Santa Barbara Islands, in deep water.

TINDARIA RITTERI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 401.
Off La Jolla, California, 203 fathoms.

(FILIBRANCHIATA.)

Superfamily ARCACEA.

Family ARCIDAE.

Genus GLYCYMERIS Da Costa, 1778.

GLYCYMERIS SEPTENTRIONALIS Middendorff, 1849.
Mal. Rossica, vol. 3, p. 67, pl. 21, figs. 1-3.
Aleutian Islands to Forrester Island, Alaska.

GLYCYMERIS SUBOBSOLETA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 644; Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 425.
Aleutian Islands to Puget Sound.

GLYCYMERIS CORTEZIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 402.
Forrester Island, Alaska, to Cortez Bank, California.

GLYCYMERIS MIGUELIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 402.
Cape Blanco, Oregon, to Magdalena Bay, Lower California, and the Cortez Bank.

GLYCYMERIS MULTICOSTATA Sowerby, 1832.
Proc. Zool. Soc., p. 195; Conch. Icon., *Pectunculus*, pl. 5, fig. 26.
(?) Monterey, California, to Gulf of California, and Guayaquil.

Genus LIMOPSIS Sasso, 1827.

LIMOPSIS SKENEA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 402.
Bowers Bank, Bering Sea, 30 fathoms.

LIMOPSIS AKUTANICA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 403.
Off Akutan Island, Aleutians, 72 fathoms.

LIMOPSIS DIEGENSIS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 395, pl. 15, figs. 13, 15.
Santa Barbara Islands to Coronado Island.

Section EMPLECONIA Dall, 1908.

LIMOPSIS VAGINATUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 190; vol. 17, p. 713, pl. 25, figs. 3, 6, 7.
Bering Sea and Aleutian Islands.

Genus ARCA Linnaeus, 1758.

Subgenus BARBATIA Gray, 1847.

Section FOSSULARCA Cossmann, 1887.

BARBATIA SOLIDA Broderip and Sowerby, 1833.
Proc. Zool. Soc., p. 18; Conch. Icon. *Arca*, pl. 16, fig. 106.
San Diego, California, to Panama.

Section ACAR Gray, 1847.

BARBATIA RETICULATA Gmelin, 1792.
Syst. Nat., vol. 7, p. 3311; Conch. Icon. *Arca*, pl. 16, fig. 108.
San Diego to Ecuador. Also Atlantic.

Subgenus SCAPHARCA Gray, 1847.

SCAPHARCA MULTICOSTATA Sowerby, 1833.
Proc. Zool. Soc., p. 21; Conch. Icon. *Arca*, pl. 4, fig. 23.
San Diego, California, to Gulf of California.

Section BATHYARCA Kobelt, 1891.

SCAPHARCA NUCLEATOR Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 397, pl. 18, fig. 9.
San Diego, California, to Panama.

SCAPHARCA (CORPULENTA Smith, 1885, variety ?) POMPHOLYX Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 398.
Off Santa Barbara, California, to the Galapagos Islands and Mid-Pacific, in deep water.

Superfamily PTERIACEA.

Family PINNIDAE.

Genus ATRINA (Gray) Adams, 1857.

ATRINA OLDROYDI Dall, 1901. (Plate 2, figs. 4, 5, 6.)
Nautilus, vol. 24, No. 12, p. 143.
Off San Pedro, California, in 25 fathoms.

Family PTERIIDAE.

Genus PTERIA Scopoli, 1777.

PTERIA VIRIDOZONA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 403.
Long Beach, California (Lowe).

PTERIA STERNA Gould, 1851.
Proc. Boston Soc. Nat. Hist., 1851, p. 93; Mex. and Cal. Shells, p. 31, pl. 16, fig. 7.
San Diego to Panama.

Genus PEDALION Solander, 1770.

PEDALION CHEMNITZIANUM Orbigny, 1845.
Moll. Cuba, vol. 2, p. 346; Conch. Cab., vol. 7, p. 250, pl. 59, fig. 580.
Coronado Islands to Panama and Chile. Also Atlantic.

? Family PHILOBRYIDAE.

Genus PHILOBRYA Carpenter, 1872.

PHILOBRYA SETOSA Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 314; Journ. de Conchyl., vol. 45, p. 10, text figs. 1, 4; pl. 1, fig. 1.
Forrester Island, Alaska, to Gulf of California.

Superfamily OSTRACEA.

Family OSTREIDAE.

Genus OSTREA Linnaeus, 1758.

OSTREA VEATCHII Gabb, 1866.
Pal. Cal., vol. 2, p. 34, pl. 11, fig. 59.
Fossil at San Diego, living in the Gulf of California.

OSTREA PALMULA Carpenter, 1857.
Mazatlan Cat., p. 163.
Puget Sound to Gulf of California.

OSTREA LURIDA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 645; Journ. de Conchyl., vol. 12, p. 137.
Sitka to Cape San Lucas.

OSTREA LURIDA EXPANSA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 646; Journ. de Conchyl., vol. 12, p. 138.
Monterey to San Diego, California.

OSTREA ELONGATA (Solander, 1786, var.) VIRGINICA Gmelin, 1792.
Syst. Nat., vol. 7, p. 3336; Conch. Cab., ed. 1, vol. 8, figs. 677, 678.
Imported from the Atlantic Coast.

Superfamily PECTINACEA.

Genus PECTEN Müller, 1776.

Subgenus Pecten s. s.

PECTEN DIEGENSIS Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 710.—Hinds, Zool. *Sulphur* Voy. Moll., pl. 17, fig. 6.
Monterey to San Diego and the Cortez Bank.

Subgenus Chlamys Bolten, 1798.

CHLAMYS HERICIUS Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 340.—Arnold, Tert. Pectens Cal., pl. 43, figs. 3, 3*a*.
Port Althorp, Alaska, to San Diego, California.

CHLAMYS (HERICIUS Gould, var.?) ALBIDUS Dall, 1906.
Arnold, Tert. Pectens Cal., p. 136, pl. 52, fig. 2.
Aleutian Islands.

CHLAMYS HASTATUS Sowerby, 1843.
Thes. Conch. *Pecten*, p. 72, pl. 20, fig. 236.—Arnold, Tert. Pectens Cal., pl. 42, figs. 1, 2.
Monterey to San Pedro, California.

CHLAMYS HINDSII Carpenter, 1864.
Suppl. Rep. Brit, Assoc., p. 645.—Arnold, Tert. Pectens Cal., pl. 43, figs. 1, 2.
Monterey to San Pedro, California.

CHLAMYS HINDSII NAVARCHUS Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 708.—Hinds, Zool. *Sulphur* Voy. Moll., pl. 17, fig. 5.
Bering Sea to San Diego, California.

CHLAMYS HINDSII KINCAIDI Oldroyd, 1920.
Nautilus, vol. 33, p. 135, pl. 4, figs. 3, 4.
Puget Sound.

CHLAMYS ISLANDICUS Müller, 1776.
Prodr. Zool. Danica, p. 248.—Arnold, Tert. Pectens Cal., p. 113, pl. 45, fig. 1.
Arctic Ocean to Kamchatka and Puget Sound. Also Atlantic.

CHLAMYS ISLANDICUS BERINGIANUS Middendorff, 1849.
Beitr. Mal. Rossica, vol. 3, p. 12.—Arnold, Tert. Pectens Cal., pl. 44, figs. 2–4.
Bering Sea.

CHLAMYS ISLANDICUS PUGETENSIS Oldroyd, 1920.
Nautilus, vol. 33, p. 136, pl. 4, figs. 5, 6.
San Juan Island.

CHLAMYS PAUCICOSTATUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 645.—Arnold, Tert. Pectens Cal., pl. 39, figs. 3, 4.
Catalina Island, California, to Gulf of California.

Section PATINOPECTEN Dall, 1898.

CHLAMYS CAURINUS Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 345.—Arnold, Tert. Pectens Cal., p. 101, pl. 38, 39.
Wrangell, Alaska, to Siletz Bay, Oregon.

Section LEPTOPECTEN Verrill, 1897.

CHLAMYS LATIAURITUS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 238, pl. 18, fig. 9.
Monterey, California, to Lower California.

CHLAMYS LATIAURITUS MONOTIMERIS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 238. pl. 18, fig. 10.
Monterey, California, to Gulf of California.

CHLAMYS LATIAURITUS FUCICOLUS Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 710; Zool. *Sulphur* Voy. Moll., pl. 17.
On floating kelp.

CHLAMYS ?TUMBEZENSIS Orbigny, 1846.
Voy. Amer. Mér., p. 663; Thes. Conch. *Pecten*, pl. 12, figs. 18, 19, 26.
Santa Barbara, California, to Peru.

Section PLAGIOCTENIUM Dall, 1898.

CHLAMYS CIRCULARIS Sowerby, 1835.
Proc. Zool. Soc., p. 110; Thes. Conch. *Pecten*, p. 49, pl. 15, figs. 105, 106.—Arnold, Tert. Pectens Cal., pl. 44, fig. 6.
Monterey, California, to Payta, Peru.

CHLAMYS CIRCULARIS AEQUISULCATUS Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 179.—Arnold, Tert. Pectens Cal., p. 132; pp. 45–46, text figs. 1, 2, pl. 50, fig. 1.
Santa Barbara to Cape San Lucas, Lower California.

Subgenus Pseudamusium H. and A. Adams, 1858.

PSEUDAMUSIUM RANDOLPHI Dall, 1897.
Nautilus, vol. 11, No. 8, p. 86; Proc. U. S. Nat. Mus., vol. 24, p. 559, pl. 40, fig. 2.
Bering Sea to Guaymas, Mexico.

PSEUDAMUSIUM TILLAMOOKENSE Arnold, 1906.
Tert. Pectens Cal., p. 139, pl. 48, fig. 3.
Pribiloff Islands, Bering Sea, to San Diego.

PSEUDAMUSIUM VANCOUVERENSE Whiteaves, 1893. (Plate 1, figs. 4, 5.)
Ottawa Nat., vol. 7, p. 133, pl. 1, fig. 1.
Bering Sea to San Diego, California.

PSEUDAMUSIUM DAVIDSONI Dall, 1897.
Nautilus, vol. 11, No. 8, p. 86; Proc. U. S. Nat. Mus., vol. 24, p. 559, pl. 40, figs. 5, 6.
Davidson and Bowers Banks, Bering Sea.

PSEUDAMUSIUM BISTRIATUM Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 404.
Off San Diego, California, in 822 fathoms.

PSEUDAMUSIUM INCONGRUUM Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 403.
Off San Diego, California, in 684 fathoms.

PSEUDAMUSIUM ANDERSONI Dall, 1918.
Sci. Res. Canadian Arctic Exp., vol. 8, pt. A, p. 19*a*, pl. 2, figs. 7, 8.
Dolphin and Union Strait, Arctic Ocean.

Subgenus PROPEAMUSIUM Gregorio, 1883.

PROPEAMUSIUM ALASKENSE Dall, 1871. (Plate 1, fig. 2.)
Amer. Journ. Conch., vol. 7, p. 155, pl. 16, fig. 4.
Pribiloff Islands, Bering Sea, and southward to the Santa Barbara Islands, California. Japan.

Genus HINNITES Defrance, 1821.

HINNITES GIGANTEUS Gray, 1825.
Ann. Phil., ser. 2, vol. 12, p. 103.—ARNOLD, Tert. Pectens Cal., pl. 29, figs. 1, 2.
Aleutian Islands to Magdalena Bay, Lower California.

Family LIMIDAE.

Genus LIMA (Bruguière) Cuvier, 1798.

Subgenus MANTELLUM Bolten, 1798.

MANTELLUM DEHISCENS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila, vol. 7, p. 247, pl. 19, fig. 7.
Monterey, California, to Acapulco, Mexico.

Subgenus LIMATULA S. Wood, 1839.

LIMATULA ATTENUATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 404.
Southern Bering Sea, the Aleutian Islands and eastward to the Shumagin Islands, Alaska.

LIMATULA SUBAURICULATA Montagu, 1808.
Test. Brit. Suppl., p. 63.—JEFFREYS, Brit. Conch., vol. 5, pl. 25, fig. 3.
British Columbia to San Quentin Bay, Lower California. Also Atlantic.

Superfamily ANOMIACEA.

Family ANOMIIDAE.

Genus ANOMIA Linnaeus, 1758.

ANOMIA PERUVIANA Orbigny, 1846.
Voy. Amer. Mér., p. 673.—Philippi, Abb. u. Beschr., vol. 3, p. 211, pl. 1, fig. 2.
San Pedro, California, to Peru and the Galapagos Islands.

Genus PODODESMUS Philippi, 1837.

Subgenus Monia Gray, 1849.

MONIA MACROSCHISMA Deshayes, 1839.
Revue Zool. Soc. Cuvierienne, p. 359.—Guérin, Mag. de Zool., 1841, pl. 34.
Southern Bering Sea from the Pribilof Islands, to Japan and the Okhotsk Sea on the west, and eastward along the whole coast to Lower California.

Superfamily MYTILACEA.

Family MYTILIDAE.

Genus MYTILUS Linnaeus, 1758.

MYTILUS CALIFORNIANUS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 242, pl. 18, fig. 15; Conch. Icon. *Mytilus*, pl. 1, fig. 2.
Unalaska, Aleutian Islands, eastward and southward to Socorro Island.

MYTILUS EDULIS Linnaeus, 1758.
Syst. Nat., ed. 10, p. 705.—Gould, Inv. Mass., fig. 82.
Arctic Ocean to Cerros Island, and worldwide in temperate waters.

Section HORMOMYA Mörch, 1853.

MYTILUS ADAMSIANUS Dunker, 1856.
Proc. Zool. Soc., p. 360; Conch. Icon. *Mytilus*, pl. 11, fig. 55.
Santa Barbara, California, to Panama and the Galapagos Islands.

MYTILUS RECURVUS Rafinesque, 1820.
Ann. Gen. Sci. Phys., vol. 5, p. 320.—Say, Amer. Conch., pt. 5, pl. 50.
Newport, California, introduced with seed oysters from the Atlantic.

Genus SEPTIFER Recluz, 1848.

SEPTIFER BIFURCATUS (Conrad) Reeve, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 241, pl. 18, fig. 14.
Crescent City, California, to Gulf of California.

SEPTIFER BIFURCATUS OBSOLETUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 404.
San Diego, California.

Genus MODIOLUS Lamarck, 1799.

MODIOLUS MODIOLUS Linnaeus, 1758.
Syst. Nat., ed. 10, p. 706: Conch. Icon., *Modiola*, pl. 1, fig. 2.
Circumboreal. On the Pacific side Arctic and Bering Seas and southward to San Pedro, California, and the outlying islands.

MODIOLUS RECTUS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 243, pl. 19, fig. 1.
Bolinas Bay, California, to Magdalena Bay, Lower California.

MODIOLUS FLABELLATUS Gould, 1850.
Boston Journ. Nat. Hist., vol. 3, p. 343; Rep. U. S. Expl. Exp. Moll., p. 453, fig. 561.
Vancouver Island to San Diego, California.

MODIOLUS CAPAX Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 242; Conch. Icon. *Modiola*, pl. 8, fig. 11.
Santa Barbara, California, to Payta, Peru.

MODIOLUS FORNICATUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 643; Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 178.
Trinidad to San Pedro and Cortez Bank, California.

MODIOLUS (POLITUS Verrill, 1880, var.?) PALLIDULUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 404.
Off Bodega Head, California, and south to Cerros Island, Lower California, in deep water.

Subgenus GREGARIELLA Monterosato, 1883.

GREGARIELLA OPIFEX Say, 1825.
Journ. Acad. Nat. Sci. Phila., vol. 4, p. 369. pl. 19, fig. 2.
Santa Barbara, California, to Gulf of California.

Subgenus BRACHYDONTES Swainson, 1840.

BRACHYDONTES DEMISSUS Dillwyn, 1817.
Descr. Cat. Rec. Shells, vol, 1, p. 314; Journ. Acad. Nat. Sci. Phila., vol. 7, pl. 20, fig. 7.
Imported with "seed" oysters from the Atlantic coast. San Francisco Bay, on oyster beds.

Genus BOTULA Mörch, 1853.

Subgenus ADULA H. and A. Adams, 1857.

ADULA DIEGENSIS Dall, 1911. (Plate 1, figs. 1, 3.)
Nautilus, vol. 24, No. 10, p. 110; vol. 30, No. 1, p. 2.
San Francisco Bay to Cape San Lucas.

ADULA FALCATA Gould, 1851.
Proc. Boston Soc. Nat. Hist., vol. 4, p. 92; Mex. and Cal. Shells, pl. 6, fig. 9.
Coos Bay, Oregon, to San Diego, California.

ADULA CALIFORNIENSIS Philippi, 1847.
Zeitschr. Mal., p. 113; Conch. Cab., ed. 2, *Lithophaga*, pl. 5, fig. 19.
Vancouver Island to San Diego, California. North Japan.

Genus DACRYDIUM Torell, 1859.

DACRYDIUM PACIFICUM Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 405.
Bering Sea, 1401 fathoms.

Genus LITHOPHAGA Bolten, 1798.

Section DIBERUS Dall, 1898.

LITHOPHAGA PLUMULA Hanley, 1844.
Proc. Zool. Soc., p. 17; Descr. Cat., p. 239, pl. 24, fig. 23.
Monterey, California, to Patagonia. Also Atlantic.

Section LABIS Dall, 1916.

LITHOPHAGA ATTENUATA Deshayes, 1836.
Anim. s. Vert., ed. 2, vol. 7, p. 28.—PHILIPPI, Abb. u. Beschr., vol. 2, p. 148, pl. 1, fig. 6.
Monterey to Patagonia.

Section MYOFORCEPS Fischer, 1886.

LITHOPHAGA ARISTATA Dillwyn, 1817.
Descr. Cat. Rec. Shells, vol. 1, p. 303.—WOOD, Index Test., pl. 12, fig. 8, 1825.
La Jolla, San Diego County, California, to Peru. Also Atlantic.

Genus MUSCULUS Bolten, 1798.

MUSCULUS NIGER Gray, 1824.
App. Parry's Voy., p. 244; Voy. de la *Recherche*, pl. 17, fig. 1.
Circumboreal. Arctic Ocean to Oregon.

MUSCULUS NIGER OBESUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 405.
Arctic Ocean to Cape Flattery.

MUSCULUS PROTRACTUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 405.
Nunivak Island, Bering Sea, to Monterey.

MUSCULUS OLIVACEUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 405.
Bering Sea to Catalina Island, California.

MUSCULUS IMPRESSUS Dall, 1907. (Plate 3, figs. 6, 7.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 172.
Petrel Bank, Bering Sea.

MUSCULUS TAYLORI Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 5, pl. 1, figs. 17, 18.
Victoria, Vancouver Island.

MUSCULUS SUBSTRIATUS Gray, 1824.
App. Parry's Voy., p. 245; Voy. de la *Recherche*, pl. 17, fig. 3.
Circumboreal. Arctic Ocean to Puget Sound.

MUSCULUS CORRUGATUS Stimpson, 1851.
Shells of N. Engl., p. 12.—GOULD, Inv. Mass., p. 130, fig. 84.
Circumboreal. Arctic Ocean to Puget Sound.

MUSCULUS VERNICOSUS Middendorff, 1849.
Mal. Rossica, vol. 3, p. 20, pl. 11, figs. 25–27.
Bering Sea to Sitka. Also Okhotsk Sea.

MUSCULUS PHENAX Dall, 1915.
Nautilus, vol. 28, No. 12, p. 138.
St. George Island, Bering Sea.

MUSCULUS MARMORATUS Forbes, 1838.
Malac. Monensis, p. 44.—Forbes and Hanley, Brit. Moll., pl. 45, fig. 4.
Circumboreal? "Puget Sound" (P. P. C.)

MUSCULUS SEMINUDUS Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 5, pl. 1, fig. 1.
Bering Sea to Forrester Island, Alaska.

Genus CRENELLA Brown, 1827.

CRENELLA DECUSSATA Montagu, 1808.
Test. Brit. Suppl., p. 69.—Forbes and Hanley, Brit. Moll., vol. 2, p. 210, pl. 45, fig. 2.
Bering Sea to the Santa Barbara Islands, California.

CRENELLA LEANA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 4, pl. 1, figs. 6, 7.
Aleutian Islands, eastward to Middleton Island, Alaska.

CRENELLA COLUMBIANA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 4, pl. 1, figs. 3, 5.
Aleutian Islands to San Diego, California.

CRENELLA DIVARICATA Orbigny, 1845.
Moll Cuba, vol. 2, p. 311, pl. 27, figs. 56–59.
Santa Barbara Islands to Panama Bay. Also West Indies.

CRENELLA GRISEA Dall, 1897.
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 171.
Bering Sea to Sitka, Alaska.

CRENELLA ROTUNDATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 406.
Santa Cruz Island, California, in 155 fathoms.

Order ANOMALODESMACEA.

A: ENSIPHONIA.

Family PERIPLOMATIDAE.

Genus PERIPLOMA Schumacher, 1817.

PERIPLOMA PLANIUSCULA Sowerby, 1834.
Proc. Zool. Soc., p. 87; Journ. Acad. Nat. Sci. Phila., vol. 7, pl. 18, fig. 8.
San Pedro, California, to Guayaquil.

PERIPLOMA DISCUS Stearns, 1890.
Proc. U. S. Nat. Mus., vol. 13, p. 222, pl. 16, figs. 1, 2.
San Pedro Bay, California, to San Diego.

Section HALISTREPTA Dall, 1904.

PERIPLOMA SULCATA Dall, 1904.
Nautilus, vol. 17, No. 11, p. 122; Bull. Mus. Comp. Zool., vol. 43, No. 5, pl. 15, fig. 10.
San Pedro Bay, Terminal Island, California.

Family THRACIIDAE.

Genus THRACIA (Leach) Blainville, 1824.

THRACIA CURTA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 8.
Arctic Ocean, Bering Sea, and south to San Diego, California.

THRACIA BERINGI Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 442.
Bering Sea, Aleutian Islands and southward to Sitka, Alaska.

THRACIA CHALLISIANA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 443.
Forrester Island, Alaska, to Gulf of Georgia.

THRACIA DIEGENSIS Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 443.
San Pedro Bay, California, to Magdalena Bay.

Genus CYATHODONTA Conrad, 1849.

CYATHODONTA DUBIOSA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 445.
San Pedro to San Diego and the Gulf of California.

CYATHODONTA PEDROANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 445.
San Pedro Harbor and Catalina Island, California.

Genus ASTHENOTHAERUS Carpenter, 1864.

ASTHENOTHAERUS VILLOSIOR Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 311.
San Pedro, California, to Cape San Lucas.

B: ADELOSIPHONIA.

Family PANDORIDAE.

Genus PANDORA Hwass, 1795.

Subgenus KENNERLIA Carpenter, 1864.

KENNERLIA GRANDIS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 11.
Pribilof Islands, Bering Sea, to Siletz Bay, Oregon.

KENNERLIA GLACIALIS Leach, 1819.
Journ. de Phys., vol. 88, p. 465.—SOWERBY, Spec. Conch., figs. 4–6.
Arctic Ocean and south to Fuca Straits. Also Atlantic.

KENNERLIA GLACIALIS EUTAENIA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 449.
Port Etches, Alaska.

KENNERLIA FILOSA Carpenter, 1864.
Proc. Zool. Soc., p. 602.—ARNOLD, Pal. San Pedro, pl. 18, fig. 3.
Nunivak Island, Bering Sea, to San Pedro, California.

KENNERLIA BILIRATA Conrad, 1855.
Proc. Acad. Nat. Sci., Phila., p. 267; Pacific R. R. Reps., vol. 6, p. 73, pl. 5, fig. 25.
Forrester Island, Alaska, south to Point Abreojos, Lower California.

KENNERLIA GRANULATA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, No. 2116, p. 449.
Santa Barbara, California, to Gulf of California.

KENNERLIA FORRESTERENSIS Willett, 1918.
Nautilus, vol. 31, No. 4, p. 134.
Forrester Island, Alaska, 50 fathoms.

Subgenus HETEROCLIDUS Dall, 1915.

HETEROCLIDUS PUNCTATUS Conrad, 1837 (not Carpenter, 1864).
Journ. Acad. Nat. Sci., Phila., vol. 7, p. 228, pl. 17, fig. 1.
Vancouver Island to Gulf of California.

Family LYONSIIDAE.

Genus LYONSIA Turton, 1822.

LYONSIA STRIATA Montagu, 1815.
Trans. Linn. Soc., vol. 11, p. 188, pl. 13, fig. 1 *A*.—TURTON, Dithyra Brit. pl. 3, figs. 6, 7.
Circumboreal. Aleutian Islands to Fuca Straits.

LYONSIA ARENOSA Moller, 1842.
Index Moll. Grönl., p. 20; Zool. Beechey's Voy., pl. 43, fig. 3.
Circumboreal. Arctic Sea to Japan and the Okhotsk Sea on the west and on the east to the Aleutians and Kodiak Island, Alaska.

LYONSIA GOULDII Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 453.—GOULD, Mex. and Cal. Shells, pl. 15, fig. 6.
San Francisco Bay, California, and south to Point Abreojos, Lower California.

LYONSIA CALIFORNICA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 20.
Puget Sound to Todos Santos Bay, Lower California.

LYONSIA CALIFORNICA HAROLDI Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 453.
Central California.

LYONSIA (CALIFORNICA var.?) NESIOTES Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 453.
Catalina and Coronado Islands, to Magdalena Bay.

LYONSIA PUGETENSIS Dall, 1913.
Proc. U. S. Nat. Mus., vol. 45, p. 595.
Chignik Bay, Alaska, to Puget Sound.

Subgenus ALLOGRAMMA Dall, 1903.

ALLOGRAMMA AMABILIS Dall, 1913.
Proc. U. S. Nat. Mus., vol. 45, p. 594.
Off Santa Barbara Channel, California, 534 fathoms.

Subgenus ENTODESMA Philippi, 1845.

ENTODESMA INFLATUM Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 10.
In sponges, Vancouver Island to Guayaquil.

Section AGRIODESMA Dall, 1900.

ENTODESMA SAXICOLA Baird, 1863.
Proc. Zool. Soc., p. 70: Proc. U. S. Nat. Mus., vol. 49, p. 456.
Aleutian Islands to Cape Colnette, Lower California.

ENTODESMA SCAMMONI Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 142, pl. 16, fig. 3.
Port Simpson, British Columbia (Scammon). San Diego (Orcutt).

Genus MYTILIMERIA Conrad, 1837.

MYTILIMERIA NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 246, pl. 19, fig. 5.
In compound Ascidians. Vancouver Island to San Diego, California.

Superfamily POROMYACEA.

Family POROMYACIDAE.

Genus POROMYA Forbes, 1844.

Subgenus DERMATOMYA Dall, 1908.

DERMATOMYA TENUICONCHA Dall, 1913. (Plate 3, fig. 10.)
Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 596.
Alaska Peninsula to Coronado Islands, in deep water.

DERMATOMYA BUTTONI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 406.
Monterey, California (Button).

DERMATOMYA BERINGIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 406.
Aleutian Islands to Tillamook, Oregon.

DERMATOMYA LEONINA Dall, 1916. (Plate 2, fig. 2.)
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 406.
Off coast of Washington, 877 fathoms.

Genus CETOCONCHA Dall, 1886.

CETOCONCHA MALESPINAE Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 407.
Southwest of Sitka, Alaska, 1,579 fathoms.

(?) Family LYONSIELLIDAE.

Genus LYONSIELLA M. Sars, 1872.

LYONSIELLA ALASKANA Dall, 1894.
Proc. U. S. Nat. Mus., vol. 17, p. 703, pl. 25, fig. 2.
Southwest of Sitka, 1,659 fathoms, and off Catalina Island, California, in 600 fathoms.

Family CUSPIDARIIDAE.

Genus CUSPIDARIA Nardo, 1840.

CUSPIDARIA GLACIALIS G. O. Sars, 1878.
Moll. Reg. Arct. Norv., p. 88. pl. 6, figs. *8a*, *8c*.
Off San Diego, California, 239 fathoms. Also Atlantic.

CUSPIDARIA SUBGLACIALIS Dall, 1913. (Plate 3, fig. 4.)
Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 593.
Off California coast, in deep water.

CUSPIDARIA APODEMA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 407.
Off Sitka, Alaska, and south to Panama Bay, in deep water.

CUSPIDARIA CHILENSIS Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 282, pl. 13, fig. 13.
Off Oregon in 277 fathoms, and south to coast of Chile in 1,036 fathoms.

CUSPIDARIA NANA Oldroyd, 1918.
Nautilus, vol. 32, No. 1, p. 28.
Baulinas to Monterey, California.

Section CARDIOMYA A. Adams, 1864.

CUSPIDARIA PECTINATA Carpenter, 1864.
Suppl. Brit. Assoc., p. 637; Proc. Acad. Nat. Sci. Phila. for 1865, p. 54.—Arnold, Pal. San Pedro, pl. 18, fig. 11.
Monterey, California, to Panama Bay.

CUSPIDARIA BERINGENSIS Leche, 1883.
Vega Exp. Vet. Arb., vol. 3, p. 438, pl. 32, figs. 1, 2; Bull. U. S. Nat. Mus., No. 37, pl. 3, fig. 6.
Bering Sea to Kodiak Island and Panama Bay.

CUSPIDARIA CALIFORNICA Dall, 1886.
Bull. Mus. Comp. Zool., vol. 12, No. 6, p. 296.
Puget Sound to San Diego, California.

CUSPIDARIA PLANETICA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 433.
Pribilof Islands, Bering Sea, to Coronado Islands, Lower California, in deep water.

CUSPIDARIA BALBOAE Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 407.
Cortez Bank, California, 60 fathoms.

Genus MYONERA Dall and Smith, 1886.

MYONERA TILLAMOOKENSIS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 407.
Off Tillamook Bay, Oregon, 786 fathoms.

Genus LEIOMYA A. Adams, 1864.

Subgenus PLECTODON Carpenter, 1864.

PLECTODON SCABER Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 638; Proc. Cal. Acad. Sci., vol. 3, p. 207.
Catalina Island, California, to San Diego.

Family VERTICORDIIDAE.

Genus VERTICORDIA Wood, 1844.

VERTICORDIA ORNATA Orbigny, 1846.
Moll. Cuba, vol. 2, p. 292, pl. 27, figs. 30–33.
Catalina Island, California, to Panama Bay. Also Japan and the Antilles.

Order TELEODESMACEA.

Superfamily ASTARTACEA.

Family ASTARTIDAE.

Genus ASTARTE Sowerby, 1816.

Section ASTARTE s. s.

ASTARTE POLARIS Dall, 1903.
Proc. U. S. Nat. Mus., vol. 26, pp. 939, 943, 945, pl. 63, fig. 5.
Aleutian and Shumagin Islands, Alaska. Circumboreal.

ASTARTE COMPACTA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 642; Proc. Acad. Nat. Sci. Phila. for 1865, p. 57; Proc. U. S. Nat. Mus., vol. 26, p. 944, pl. 63, fig. 8.
Forrester Island to Puget Sound.

ASTARTE WILLETTI Dall, 1917.
Nautilus, vol. 31, No. 1, p. 10.
Forrester Island, 50 fathoms.

Section TRIDONTA Schumacher, 1817.

ASTARTE ROLLANDI Bernardi, 1858.
Journ. de Conchyl., vol. 7, p. 386, pl. 13, fig. 4.
Pribilof and Aleutian Islands to Prince William Sound, Alaska.
Also Kamchatka.

ASTARTE ROLLANDI LOXIA Dall, 1902.
Proc. U. S. Nat. Mus., vol. 26, No. 1342, p. 943.
Semidi Islands, Alaska.

ASTARTE ARCTICA Gray, 1824.
App. Parry's Voy., p. 243.—Sars, Moll. Reg. Arct. Norv., pl. 5, fig. 8.
Circumboreal. Arctic and Bering Seas and the Aleutian Islands.

ASTARTE BOREALIS Schumacher, 1817.
Essai, p. 47, pl. 17, fig. 1.
Polar and Bering Seas, North Japan, and eastward to Prince William Sound, Alaska.

ASTARTE ALASKENSIS Dall, 1903.
Proc. U. S. Nat. Mus., vol. 26, No. 1342, pp. 944, 946, pl. 63, fig. 2.
Southern Bering Sea, the Aleutians and south to Puget Sound. Herschell Island, Arctic Coast.

ASTARTE FABULA Reeve, 1855.
Last of the Arctic Voy., vol. 2, p. 398, pl. 33, fig. 5.
Circumboreal, Arctic Sea and south in Bering Sea to Nunivak Island.

ASTARTE BENNETTII Dall, 1903.
Proc. U. S. Nat. Mus., vol. 26, No. 1342, pp. 945–6, pl. 63, fig. 6.
Polar Sea at Bennett Island, and south in Bering Sea to Nunivak Island.

ASTARTE VERNICOSA Dall, 1903.
Proc. U. S. Nat. Mus., vol. 26, No. 1342, pp. 945, 948, pl. 63, fig. 1.
Arctic and Bering Seas. Attu to Atka Islands in the Aleutian chain.

ASTARTE GLOBOSA Moller, 1842.
Index Moll. Grönl., p. 20.—Reeve, Last of the Arctic Voy., vol. 3, 398, pl. 33, fig. 6.
Arctic Coast to Greenland.

Section RICTOCYMA Dall, 1872.

ASTARTE ESQUIMALTI Baird, 1863.
Proc. Zool. Soc., p. 70; Proc. U. S. Nat. Mus., vol 26, pl. 63, figs. 11, 12.
Aleutian Islands to Puget Sound.

Genus BERNARDINA Dall, 1910.

BERNARDINA BAKERI Dall, 1910.
Proc. Biol. Soc. Wash., vol. 23, p. 171.
Coronado Islands.

Family CRASSATELLITIDAE.

Genus CRASSATELLITES Kruger, 1823.

CRASSATELLITES FLUCTUATUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 642; Proc. Cal. Acad. Sci., vol. 3, p. 209.
Santa Barbara Islands, California.

Genus CRASSINELLA Guppy, 1875.

CRASSINELLA BRANNERI Arnold, 1903.
Pal. San Pedro, p. 127, pl. 18, fig. 12.
San Diego, California, to Panama. Pleistocene of San Pedro, California.

Superfamily CARDITACEA.

Family CARDITIDAE.

Genus CARDITA (Bruguière) Lamarck, 1799.

Section CARDITAMERA Conrad, 1838.

CARDITA SUBQUADRATA Carpenter, 1865.
Suppl. Rep. Assoc., p. 642; Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 179.—Keep, West Coast Shells, fig. 152.
Queen Charlotte Islands to Todos Santos Bay.

Genus VENERICARDIA Lamarck, 1801.

Section CYCLOCARDIA Conrad, 1867.

VENERICARDIA BARBARENSIS Stearns, 1890.
Proc. U. S. Nat. Mus., vol. 13, p. 214, pl. 16, figs. 4, 3.
Santa Barbara Channel to San Diego, California, in deep water.

VENERICARDIA GOULDII Dall, 1902.
Proc. Acad. Nat. Sci. Phila., pp. 709, 714; Proc. U. S. Nat. Mus., vol. 26, No. 1342, pl. 63, fig. 3.
Off San Diego, California.

VENERICARDIA STEARNSII Dall, 1902.
Proc. Acad. Nat. Sci. Phila., pp. 709, 714; Proc. U. S. Nat. Mus., vol. 13, 1890, p. 216, pl. 16, figs. 5, 6.
Puget Sound.

VENERICARDIA PAUCICOSTATA Krause, 1885.
Arch. f. Naturg., vol. 51, Heft 1, p. 30, pl. 3, fig. 3.
Arctic Sea to Fuca Straits.

VENERICARDIA CREBRICOSTATA Krause, 1885.
Arch. f. Naturg., vol. 51, Heft 1, p. 30, pl. 3, fig. 4; Proc. U. S. Nat. Mus., vol. 26, pl. 63, fig. 7.
Point Barrow, Alaska, to Monterey, California.

VENERICARDIA CRASSIDENS Broderip and Sowerby, 1829.
Zool. Journ., vol. 4, p. 365; Proc. U. S. Nat. Mus., vol. 26, p. 949, pl. 43, fig. 9.
Arctic and Bering Seas and eastward to Kodiak Island, Alaska.

VENERICARDIA NODULOSA Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 249.
Santa Barbara to the Coronado Islands.

VENERICARDIA MONILICOSTA Gabb, 1861.
Proc. Acad. Nat. Sci. Phila., p. 371.
Santa Barbara, Pleistocene. Recent?

VENERICARDIA VENTRICOSA Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 276; Rep. U. S. Expl. Exp. Moll., p. 417, fig. 532.
Belkoffski Bay, Alaska, to Coronado Islands and Cortez Bank, California.

VENERICARDIA INCISA Dall, 1902.
Proc. Acad. Nat. Sci. Phila., pp. 710, 714; Proc. U. S. Nat. Mus., vol. 26, No. 1342, pl. 63, fig. 4.
Unalaska to the Semidi Islands, Alaska.

Subgenus MIODONTISCUS Dall, 1903.

MIODONTISCUS PROLONGATUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 642; Proc. U. S. Nat. Mus., vol. 18, pl. 16 figs. 7, 9.
Middleton Island, Alaska, to San Diego, California.

MIODONTISCUS MERIDIONALIS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 408.
Off Point Loma, California, 70 fathoms.

Genus CALYPTOGENA Dall, 1891.

CALYPTOGENA PACIFICA Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 190; vol. 17, pl. 25, figs. 4, 5.
Clarence Strait, Alaska, to Santa Barbara Channel, California.

CALYPTOGENA ELONGATA Dall, 1916. (Plate 3, fig. 3.)
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 408.
Santa Barbara Islands to San Diego.

Genus MILNERIA Dall, 1881.

MILNERIA MINIMA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 152, pl. 16, figs. 5, 6.
Monterey to Rosario Bay, Lower California, on *Haliotis*.

MILNERIA KELSEYI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 408; vol. 8, pl. 25, figs. 4, 7.
Monterey to Point Abreojos, Lower California, under stones.

Superfamily CHAMACEA.

Family CHAMIDAE.

Genus CHAMA Linnaeus, 1758.

CHAMA PELLUCIDA Sowerby, 1834.
Proc. Zool. Soc., p. 150.—Keep, West Coast Shells, fig. 155.
Oregon to Chile, and Galapagos Islands.

CHAMA FRONDOSA Broderip, 1834.
Proc. Zool. Soc., p. 149; Trans. Zool. Soc., vol. 5, pl. 38, figs. 1, 2.
San Diego, California, to Peru.

CHAMA BUDDIANA C. B. Adams, 1850.
Panama Shells, p. 253.
Bodega Bay, California, to Panama.

Genus PSEUDOCHAMA Odhner, 1917.

PSEUDOCHAMA EXOGYRA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 256; Conch. Icon. *Chama*, pl. 7, fig. 38.
Oregon to Panama.

Superfamily LUCINACEA.

Family THYASIRIDAE.

Genus THYASIRA (Leach in) Lamarck, 1818.

THYASIRA BISECTA Conrad, 1849.
Rep. U. S. Expl. Exp., vol. 10, p. 724, pl. 17, fig. 10; Proc. U. S. Nat. Mus., vol. 17, pl. 26, figs. 2, 5.
Off Alaska Peninsula and southward to Oregon coast. Also Miocene and Pliocene.

THYASIRA GOULDII Philippi, 1845.
Zeitschr. Mal., vol. 2, p. 74; Binney's Gould's Inv. of Mass., p. 100, fig. 206.
Bering Strait to San Diego. Also Atlantic.

THYASIRA TRISINUATA Orbigny, 1846.
Moll. Cuba, vol. 2, p. 300, pl. 27, figs. 46, 49.
Sitka, Alaska, to San Diego, California. Also Atlantic.

THYASIRA TRISINUATA POLYGONA Jeffreys, 1863.
British Conch., vol. 2, p. 248.
Korea. Gulf of Alaska to San Diego. Also Atlantic.

THYASIRA CYGNUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 409.
Southeastern Alaska.

THYASIRA BARBARENSIS Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 261, pl. 8, fig. 9.
Fuca Straits to Gulf of California.

THYASIRA EXCAVATA Dall, 1901.
Proc. U. S. Nat. Mus., vol. 23, pp. 790, 818, pl. 39, figs. 12, 15.
Oregon to Gulf of California.

THYASIRA TRICARINATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 409.
Off Santa Barbara Islands, California, in 1,100 fathoms.

Subgenus AXINULUS Verrill and Bush, 1898.

AXINULUS FERRUGINOSUS Forbes, 1844.
Rep. Brit. Assoc. for 1843, p. 192.—FORBES and HANLEY, Brit. Moll., vol. 2, p. 60, pl. 34, fig. 1.
Aleutian Islands. Also Atlantic and Arctic.

Genus AXINOPSIS G. O. Sars, 1878.

AXINOPSIS VIRIDIS Dall, 1901.
Proc. U. S. Nat. Mus., vol. 23, p. 819, pl. 40, fig. 1.
Arctic Ocean, on the west to Japan, on the east to the Aleutian and Coronado Islands.

AXINOPSIS SERICATUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 643; Proc. U. S. Nat. Mus., vol. 23, p. 819, pl. 40, fig. 2.
Aleutian Islands south and east to Puget Sound, and Catalina Island, California.

Family DIPLODONTIDAE.

Genus DIPLODONTA Bronn, 1831.

DIPLODONTA ALEUTICA Dall, 1901.
Proc. U. S. Nat. Mus., vol. 23, p. 820, pl. 42, fig. 3.
Cape Lisburne, Arctic Ocean, to the Aleutians and eastward to Sitka Bay, Alaska.

DIPLODONTA ORBELLA Gould, 1852.
Proc. Boston Soc. Nat. Hist., vol. 4, p. 90; Boston Journ. Nat. Hist., vol. 6, pl. 15, fig. 3.
Pribilof Islands, Bering Sea, to Gulf of California.

DIPLODONTA SUBQUADRATA Carpenter, 1855.
Proc. Zool. Soc., p. 230.
Catalina Island, California, to Panama.

Subgenus FELANIELLA Dall, 1899.

FELANIELLA SERICATA Reeve, 1850.
Conch. Icon. *Lucina*, pl. 9, fig. 55.
San Diego, California, to Panama.

Family LUCINIDAE.

Genus LUCINA Bruguière, 1797.

LUCINA EDENTULOIDES Verrill, 1870.
Amer. Journ. Sci., vol. 49, No. 6, p. 226.
San Clemente Island, California, to Gulf of California.

Genus PHACOIDES Gray, 1847.

Subgenus Here Gabb, 1866.

HERE RICHTHOFENI Gabb, 1866.
Pal. Cal., vol. 2, p. 29, pl. 8, fig. 49; Proc. U. S. Nat. Mus., vol. 23, pl. 40, figs. 7, 9.
San Pedro, California, to Cape San Lucas.

Subgenus Lucinisca Dall, 1901.

LUCINISCA NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 255, pl. 20, fig. 2.
Santa Barbara, California, to Mazatlan, Mexico.

Subgenus Lucinoma Dall, 1901.

LUCINOMA ANNULATA Reeve, 1850.
Conch. Icon.-*Lucina*, pl. 4, fig. 17; Proc. U. S. Nat. Mus., vol. 23, pl. 40, fig. 10.
Port Althorp, Alaska, to Coronado Islands.

LUCINOMA ANNULATA DENSILINEATA Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 249.
Sitka, Alaska, to Esteros Bay, California.

LUCINOMA AEQUIZONATA Stearns, 1890.
Proc. U. S. Nat. Mus., vol. 13, p. 220, pl. 17, figs. 3, 4.
Santa Barbara Islands to south latitude 38° (Chile).

Subgenus Callucina Dall, 1901.

Section EPILUCINA Dall, 1901.

CALLUCINA CALIFORNICA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 255, pl. 20, fig. 1.
Crescent City, California, to San Ignacio Lagoon, Lower California.

Subgenus Parvilucina Dall, 1901.

PARVILUCINA TENUISCULPTA Carpenter, 1865.
Suppl. Rep. Brit. Assoc., p. 642; Proc. U. S. Nat. Mus., vol. 23, p. 828, pl. 40, fig. 5.
Nunivak Island, Bering Sea, to the Coronado Islands, Lower California.

PARVILUCINA APPROXIMATA Dall, 1901.
Proc. U. S. Nat. Mus., vol. 23, p. 813, pl. 39, fig. 4.
Monterey, California, to Panama.

Genus DIVARICELLA Martens, 1880.

DIVARICELLA PERPARVULA Dall, 1901.
Proc. U. S. Nat. Mus., vol. 23, p. 815, pl. 39, fig. 8.
"Monterey" (Gabb). Cape San Lucas to Ecuador.

Superfamily LEPTONACEA.

Family LEPTONIDAE.

Genus ERYCINA Lamarck, 1806.

ERYCINA CATALINAE Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 409.
Catalina Island, California.

ERYCINA CORONATA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 409.
Off Coronado Islands, Lower California.

ERYCINA BAKERI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 410.
Off South Coronado Island, Lower California.

ERYCINA BALLIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 410.
Off South Coronado Island, Lower California.

ERYCINA CHACEI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 410.
Santa Rosa Island to Coronado Islands.

ERYCINA SANTAROSAE Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 410.
Santa Rosa Island, California.

Genus KELLIA Turton, 1822.

KELLIA LAPEROUSII Deshayes, 1839.
Rev. Zool. Soc. Cuvierienne, p. 357.—GUÉRIN, Mag. de Zool., Moll., pl. 12, 1840.
Bering and Pribilof Islands, Bering Sea, and south to San Diego, California.

KELLIA SUBORBICULARIS Montagu, 1804.
Test. Brit., pp. 39, 564, pl. 26, fig. 6.—TURTON, Dithyra Brit., p. 57, pl. 11, figs. 5, 6.
Bering Island, the Aleutians, and south to Panama. Also Atlantic.

Genus ALIGENA H. C. Lea, 1845.

ALIGENA CERITTENSIS Arnold, 1903.
Pal. San Pedro, p. 138, pl. 13, fig. 3.
Pleistocene, San Pedro, California. Recent, La Jolla to Magdalena Bay.

Genus ROCHEFORTIA Velain, 1846.

ROCHEFORTIA TUMIDA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 129; Proc. U. S. Nat. Mus., vol. 21, p. 892, pl. 87, fig. 7.
Shumagin Islands, Alaska, to San Diego, California.

ROCHEFORTIA PLANATA Dall, 1885.
Arch. f. Naturg, vol. 51, p. 34, pl. 3, fig. 6; Proc. U. S. Nat. Mus., vol. 21, p. 892, pl. 88, fig. 12, 1899.
Icy Cape, Arctic Ocean, south to the Shumagin Islands, Alaska.

ROCHEFORTIA FERRUGINOSA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 411.
San Francisco Bay to Santa Rosa Island, California.

ROCHEFORTIA BERINGENSIS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 411.
Bering Island, Bering Sea.

ROCHEFORTIA GREBNITZSKII Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 411.
Bering Island, Bering Sea.

ROCHEFORTIA ALEUTICA Dall, 1899.
Proc. U. S. Nat. Mus., vol. 21, p. 892, pl. 87, fig. 6.
Bering Sea to Coronado Islands.

ROCHEFORTIA COMPRESSA Dall, 1911. **(Plate 3, fig. 1.)**
Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 596.
Shumagin Islands, Alaska, to Gulf of California.

ROCHEFORTIA PEDROANA Dall, 1899.
Proc. U. S. Nat. Mus., vol. 21, p. 893, pl. 88, fig. 4.
San Pedro, California.

ROCHEFORTIA GRIPPI Dall, 1912.
Nautilus, vol. 25, No. 11, p. 128.
San Diego, California.

ROCHEFORTIA GOLISCHI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 411.
Off Santa Rosa Islands, California.

Genus SERRIDENS Dall, 1899.

SERRIDENS OBLONGA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 643; Proc. Cal. Acad. Sci., vol. 3, p. 210.
San Pedro to Coronado Islands.

Genus PSEUDOPYTHINA Fischer, 1884.

PSEUDOPYTHINA RUGIFERA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 643.—WHITEAVES, Rep. Progress, Geol. Surv. Canada, 1880, p. 198 B, fig. 2.
Commensal with *Gebia*. Puget Sound.

PSEUDOPYTHINA COMPRESSA Dall, 1899.

Proc. U. S. Nat. Mus., vol. 21, p. 888, pl. 87, figs. 1, 8.

Cape Lisburne, Arctic Ocean, to Acapulco. Commensal with Crustacean.

PSEUDOPYTHINA MYACIFORMIS Dall, 1916.

Proc. U. S. Nat. Mus., vol. 52, p. 412.

Commensal with Crustacean. Puget Sound.

Genus BORNIA Philippi, 1836.

BORNIA RETIFERA Dall, 1899.

Proc. U. S. Nat. Mus., vol. 21, p. 889, pl. 87, fig. 2.

Monterey to Santa Barbara Islands, California.

Genus LEPTON Turton, 1822.

LEPTON MEROËUM Carpenter, 1864.

Suppl. Rep. Brit. Assoc., p. 643.

San Diego, California.

Genus LASAEA Leach, 1827.

LASAEA RUBRA Montagu, 1804.

Test. Brit., p. 83, pl. 27, fig. 4.—Turton, Dithyra Brit., p. 57, pl. 11, figs. 7–8.

Vancouver Island, British Columbia, to Callao, Peru. Also Atlantic.

Genus TURTONIA Alder, 1848.

TURTONIA MINUTA Fabricius, 1780.

Fauna Grönl., p. 412.—Forbes and Hanley, Brit. Moll., vol. 2, p. 81, pl. 18, fig. 7.

Bering Strait and south to Magdalena Bay, Lower California. Also Northern Atlantic.

TURTONIA OCCIDENTALIS Dall, 1871.

Amer. Journ. Conch., vol. 7, p. 150, pl. 14, figs. 12, 13.

Plover Bay, Bering Sea.

Genus SPORTELLA Deshayes, 1858.

SPORTELLA CALIFORNICA Dall, 1899.

Proc. U. S. Nat. Mus., vol. 21, p. 885, pl. 88, fig. 5.

Monterey, California.

Genus ANISODONTA Deshayes, 1858.

ANISODONTA? PELLUCIDA Dall, 1916.

Proc. U. S. Nat. Mus., vol. 52, p. 411.

Monterey Bay, California, off Del Monte.

Family CHLAMYDOCONCHIDAE.

Genus CHLAMYDOCONCHA Dall, 1884.

CHLAMYDOCONCHA ORCUTTI Dall, 1884.

Science, vol. 4, No. 76, p. 50.—Bernard, Ann. Sci. Nat., ser. 8, vol. 4, Zool. 1897, p. 221–252, pl. 1, 2.

Monterey to False Bay, San Diego County, California.

Superfamily CARDIACEA.

Family CARDIIDAE.

Genus CARDIUM Linnaeus, 1758.

Subgenus TRACHYCARDIUM Mörch, 1853.

TRACHYCARDIUM QUADRAGENARIUM Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., p. 230, pl. 17, fig. 5.
Santa Barbara, California, to Todos Santos Bay, Lower California.

Subgenus CERASTODERMA Mörch, 1853.

CERASTODERMA CORBIS Martyn, 1784.
Figs. Nondescript Shells, table 2, pl. 80; Univ. Cal. Zool. Publ., vol. 14, pl. 20, fig. 1.
Nunivak, Pribilof, and Commander Islands, Bering Sea, south to Hakodate, Japan, and San Diego, California (Lower California?).

CERASTODERMA CILIATUM Fabricius, 1780.
Fauna Grönl., p. 410; Binney's Gould's Inv. Mass., p. 140, fig. 150.
Circumboreal. Arctic Ocean and southward to Puget Sound and North Japan.

CERASTODERMA DECORATUM Grewingk, 1850.
Verh. Min. Ges. zu St. Petersburg, 1848–9, p. 274, pl. 4, figs. 3 *a–g*.
Pleistocene of Alaska and British Columbia. Recent?

CERASTODERMA CALIFORNIENSE Deshayes, 1841. (Plate 14, fig. 8.)
GUÉRIN, Mag. de Zool., Moll., pl. 47.
Arctic Ocean to San Diego, California, North Japan and Okhotsk Sea.

CERASTODERMA CALIFORNIENSE COMOXENSE Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, No. 1214, p. 390.
Pleistocene of Vancouver Island. Recent ?

CERASTODERMA FUCANUM Dall, 1907.
Nautilus, vol. 20, No. 10, p. 112.
Southern Bering Sea, off Unimak Island, and south to Monterey, California.

? Subgenus RINGICARDIUM Fischer, 1887.

RINGICARDIUM PROCERUM Sowerby, 1833.
Proc. Zool. Soc., p. 83; Conch. Ill. *Cardium*, fig. 23.
Pleistocene, San Diego. Cerros Island to Payta, Peru.

Subgenus FRAGUM Bolten, 1798.

FRAGUM BIANGULATUM Sowerby, 1829.
Zool. Journ., vol. 5, pt. 4, p. 367; Conch. Ill. *Cardium*, fig. 2.
San Pedro, California, to Panama.

Subgenus TRIGONIOCARDIA Dall, 1900.

TRIGONIOCARDIA EUDOXIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 412.
Catalina Island, California, to Gulf of California.

Subgenus LAEVICARDIUM Swainson, 1840.

LAEVICARDIUM ELATUM Sowerby, 1833.
Proc. Zool. Soc., p. 84; Conch. Ill. *Cardium*, fig. 3.
San Pedro, California, south to Panama.

LAEVICARDIUM SUBSTRIATUM Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 228, pl. 17, fig. 2.
Catalina Island and San Pedro, California, to Acapulco.

Genus SERRIPES Beck, 1841.

SERRIPES GRÖNLANDICUS Gmelin, 1792.
Syst. Nat., vol. 7, p. 3232; Binney's Gould's Inv. Mass., p. 145, fig. 454.
Circumboreal. Arctic Seas and south to Hakodate, Japan, and Puget Sound.

SERRIPES LAPEROUSII Deshayes, 1839.
Rev. Zool. Soc. Cuvierienne, p. 360.—GUÉRIN, Mag. de Zool., Moll., pl. 48, 1841.
Bering Strait to Hakodate, Japan, and Sitka, Alaska.

Genus PROTOCARDIA Beyrich, 1845.

PROTOCARDIA CENTIFILOSA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 642; Univ. Cal. Zool. Publ., vol. 14, pl. 20, fig. 2 *a–d*.
Bodega Bay to Lower California.

PROTOCARDIA CENTIFILOSA RICHARDSONII Whiteaves, 1878. (Plate 2, fig. 3.)
Canadian Nat., ser. 2, vol. 8, p. 469.
Queen Charlotte Islands to San Francisco.

Family VESICOMYACIDAE.

Genus VESICOMYA Dall, 1886.

VESICOMYA OVALIS Dall, 1896.
Proc. U. S. Nat. Mus., vol. 18, p. 18; Bull. Mus. Comp. Zool., vol. 43, p. 417.
Clarence Strait, Alaska, 322 fathoms, and in Panama Bay, in 1,672 fathoms.

VESICOMYA LEPTA Dall, 1896.
Proc. U. S. Nat. Mus., vol. 18, p. 17; Bull. Mus. Comp. Zool., vol. 43, p. 416, pl. 18, figs. 12, 14.
Off Tillamook, Oregon, and south to the Gulf of California, in deep water.

VESICOMYA STEARNSII Dall, 1895. (Plate 1, figs. 6, 7.)
Proc. U. S. Nat. Mus., vol. 17, pp. 693, 696, fig. 1 *A*; vol. 18, p. 17.
Off La Jolla, California, and south to the Gulf of California, in deep water

Subgenus ARCHIVESICA Dall, 1908.

ARCHIVESICA GIGAS Dall, 1896.
Proc. U. S. Nat. Mus., vol. 18, p. 18; Bull. Mus. Comp. Zool., vol. 43, p. 418, pl. 16, fig. 9.
Off Point Sur, California, and in the Gulf of California, in deep water.

Superfamily VENERACEA.

Family VENERIDAE.

Subfamily Dosiniinae.

Genus DOSINIA Scopoli, 1777.

Section DOSINIDIA Dall, 1902.

DOSINIA PONDEROSA Gray, 1838.

The Analyst, vol. 8, No. 24, p. 309.—Sowerby, Thes. Conch. *Artemis*, pl. 140, fig. 2.

San Diego, California, and south to Payta, Peru.

Subfamily Meretricinae.

Genus TIVELA Link, 1807.

Subgenus Pachydesma Conrad, 1854.

PACHYDESMA STULTORUM Mawe, 1823.

Linn. Syst. Conch., p. 37, pl. 9, fig. 7; Proc. U. S. Nat. Mus., vol. 21, pl. 23, 24, 25.

Santa Cruz, California, and south to Socorro Island.

Genus TRANSENNELLA Dall, 1883.

TRANSENNELLA TANTILLA Gould, 1852.

Boston Journ. Nat. Hist. vol. 6, p. 406, pl. 15, fig. 10; (separates, Apr. 1852).

Sitka Harbor, Alaska, and south to Lower California.

Genus AMIANTIS Carpenter, 1863.

AMIANTIS CALLOSA Conrad, 1837.

Journ. Acad. Nat. Sci., vol. 7, p. 252; Thes. Conch. *Venus*, pl. 114, figs. 44, 45.

San Pedro, California, to Gulf of Tehuantepec.

Genus PITARIA (Roemer), 1857.

PITARIA NEWCOMBIANA Gabb, 1865.

Proc. Cal. Acad. Sci., vol. 3, p. 189; Proc. U. S. Nat. Mus., vol. 15, pl. 23, fig. 4.

Monterey, California, to the Gulf of California and Clarion Island.

Genus ANTIGONA Schumacher, 1817.

Section VENTRICOLA Roemer, 1857.

ANTIGONA FORDI Yates, 1890.

Santa Barbara Soc. Nat. Hist., Bull. No. 2, p. 46, pl. 1, figs. 1–5.

Monterey, California, to Lower California. Panama?

Genus SAXIDOMUS Conrad, 1837.

SAXIDOMUS NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci., Phila., vol. 7, p. 249, pl. 19, fig. 12.
Baulinas Bay, California, to San Diego.

SAXIDOMUS GIGANTEUS Deshayes, 1839.
Revue Zool. Soc. Cuvierienne, p. 359.—GUÉRIN, Mag. de Zool. Moll., 1841, pl. 43; Bull. U. S. Fish Comm., vol 3, p. 355, fig. 2.
Aleutian Islands from Attu eastward and south to Monterey, California.

SAXIDOMUS GIGANTEUS BREVIS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 413.
Admiralty Island, Alaska, to Tacoma, Washington.

Subfamily VENERINAE.

Genus CHIONE Megerle, 1811.

CHIONE FLUCTIFRAGA Sowerby, 1853.
Thes. Conch. *Venus*, p. 712, pl. 154, figs. 42, 43.
San Pedro, California, to the Gulf of California.

CHIONE UNDATELLA Sowerby, 1835.
Proc. Zool. Soc., p. 22; Thes. Conch., *Venus*, p. 711, pl. 153, fig. 22.
San Pedro, California, and south to Guayaquil.

CHIONE SUCCINCTA Valenciennes, 1832.
HUMBOLDT and BONPLAND, Obs. Zool., p. 219, pl. 48, figs. 1 *a–e*.
San Pedro, California, to Panama.

Genus VENUS (Linnaeus) Lamarck, 1799.

VENUS KENNICOTTII Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 147, pl. 16, fig. 1; Proc. U. S. Nat. Mus., vol. 24, p. 560, pl. 40, fig. 7, 1902.
Neah Bay, Washington, to Little River, Mendocino County, California.

Genus MARCIA H. and A. Adams, 1857.

MARCIA KENNERLYI (Carpenter) Reeve, 1863.
Conch. Icon. *Venus*, sp. 41; Proc. U. S. Nat. Mus., vol. 26, p. 396, pl. 14, fig. 1.
Kodiak Island, Alaska, to Carmel Bay, California.

Section VENERELLA Cossmann, 1886.

MARCIA SUBDIAPHANA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 640; Proc. U. S. Nat. Mus., vol. 14, p. 185, pl. 7, figs. 5, 6.
Sannakh Islands, Alaska, to the Santa Barbara Islands, California.

Genus PAPHIA Bolten, 1798.

Subgenus PROTOTHACA Dall, 1902.

Section CALLITHACA Dall, 1902.

PROTOTHACA TENERRIMA Carpenter, 1856.

Proc. Zool. Soc., p. 200; Univ. Cal. Zool. Publ., vol. 14, p. 272, pl. 22.

Puget Sound to San Quentin Bay, Lower California.

Section PROTOTHACA s. s.

PROTOTHACA STAMINEA Conrad, 1837.

Journ. Acad. Nat. Sci. Phila., vol. 7, p. 250, pl. 19, fig. 15.

Commander and Aleutian Islands, to Kamchatka and North Japan, and to Puget Sound and Socorro Island.

PROTOTHACA STAMINEA STAMINEA Conrad, 1837.

Journ. Acad. Nat. Sci. Phila., vol. 7, p. 250, pl. 19, fig. 15.

Crescent City, California, to Socorro Island.

PROTOTHACA STAMINEA RUDERATA Deshayes, 1853.

Cat. Conch. Brit. Mus., vol. 1, p. 136.

Southern Bering Sea to Lobitas, California.

PROTOTHACA STAMINEA PETITII Deshayes, 1839.

Revue Zool. Soc. Cuvierienne, p. 359.—GUÉRIN, Mag. de Zool. Moll., 1841, pl. 39.

Aleutian Islands to San Quentin Bay, Lower California.

PROTOTHACA STAMINEA LACINIATA Carpenter, 1864.

Suppl. Rep. Brit. Assoc., p. 641; Journ. de Conchyl., vol. 12, p. 136.—ARNOLD, Pal. San Pedro, pl. 14, fig. 5.

Unalaska, Alaska, to San Diego, California.

PROTOTHACA STAMINEA ORBELLA Carpenter, 1864.

Suppl. Rep. Brit. Soc., p. 641; Univ. Cal. Zool. Publ., vol. 14, p. 271, pl. 19, fig. 6.

Kodiak Island, Alaska, to San Diego, California.

PROTOTHACA STAMINEA SPATIOSA Dall, 1916.

Proc. U. S. Nat. Mus., vol. 52, p. 413.

Puget Sound to Anaheim Bay, California.

PROTOTHACA GRATA Say, 1831.

Amer. Conch., vol. 3, pl. 26.

San Pedro (Williamson). Gulf of California to Panama.

Genus LIOCYMA Dall, 1870.

LIOCYMA BECKII Dall, 1870.

Proc. Boston Soc. Nat. Hist., vol. 13, p. 257; Amer. Journ. Conch., vol. 7, p. 145, pl. 14, fig. 7.

Plover Bay to North Japan, on the east to Port Althorp, Alaska.

LIOCYMA SCAMMONI Dall, 1871.

Amer. Journ. Conch., vol. 7, p. 145, pl. 14, fig. 9.

Port Simpson, British Columbia.

LIOCYMA VIRIDIS Dall, 1871.

Amer. Journ. Conch., vol. 7, p. 146, pl. 14, fig. 8.

Arctic Sea southward to North Japan, and on the east to the Kodiak Islands, Alaska.

Genus VENERUPIS Lamarck, 1818.

VENERUPIS LAMELLIFERA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 251, pl. 19, fig. 19.
Monterey to San Diego, California.

Subfamily GEMMINAE.

Genus GEMMA Deshayes, 1853.

GEMMA GEMMA Totten, 1834.
Amer. Journ. Sci., vol. 26, No. 2, p. 367, fig. 2.
San Juan Islands to San Francisco Bay. Introduced from the Atlantic Coast with "seed" oysters. (San Diego?)

Genus PSEPHIDIA Dall, 1902.

PSEPHIDIA LORDI Baird, 1863.
Proc. Zool. Soc., p. 69, pl. 2, fig. 10; Proc. U. S. Nat. Mus., vol. 26, pl. 16, fig. 5.
Unalaska, Alaska, to Coronado Islands.

PSEPHIDIA OVALIS Dall, 1902.
Proc. U. S. Nat. Mus., vol. 26, p. 407, pl. 16, fig. 4.
St. Paul Island, Bering Sea, to San Diego, California.

PSEPHIDIA CYMATA Dall, 1913. **(Plate 3, fig. 2.)**
Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 593.
Santa Barbara Islands, California, to Gulf of California.

PSEPHIDIA BRUNNEA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 413.
Monterey, California, to San Ipolito Point, Lower California.

? PSEPHIDIA SALMONEA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 641; Proc. Cal. Acad. Sci., vol. 3, p. 209.
Catalina Island to San Diego, California.

Family PETRICOLIDAE.

Genus PETRICOLA Lamarck, 1801.

PETRICOLA CARDITOIDES Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 255, pl. 20, fig. 8.
Vancouver Island to Magdalena Bay, Lower California.

Subgenus PETRICOLARIA Stoliczka, 1870.

PETRICOLARIA DENTICULATA Sowerby, 1834.
Proc. Zool. Soc., p. 46; Conch. *Petricola*, p. 773, pl. 166, figs. 6, 7.
Monterey to Payta, Peru.

? Family COOPERELLIDAE.

Genus COOPERELLA Carpenter, 1864.

COOPERELLA SUBDIAPHANA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 639.—Arnold, Pal. San Pedro, p. 153, pl. 13, fig. 1.
Queen Charlotte Islands to Gulf of California.

Superfamily TELLINACEA.

Family TELLINIDAE.

Genus TELLINA (Linnaeus) Lamarck, 1799.

TELLINA IDAE Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 183, pl. 6, fig. 3; pl. 7, figs. 1, 4; vol. 23, pl. 4, figs. 10, 11.
Santa Barbara Islands and San Pedro, California.

Subgenus Arcopagia Leach, 1827.

Section MERISCA Dall, 1900.

ARCOPAGIA LAMELLATA Carpenter, 1857.
Mazatlan Cat., p. 37, No. 58.
San Diego, California, to Mazatlan.

ARCOPAGIA DECLIVIS Sowerby, 1868.
Conch. Icon. *Tellina*, pl. 44, fig. 261.
Catalina Island, California, to Panama.

Subgenus Moerella Fischer, 1887.

MOERELLA SALMONEA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 639; Univ. Cal. Zool. Publ., vol. 14, p. 276, pl. 25, fig. 3.
Aleutian Islands to San Pedro, California.

MOERELLA MEROPSIS Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, pp. 303, 317, pl. 3, fig. 1.
San Diego, California, to the Gulf of California.

Subgenus Angulus Megerle, 1811.

ANGULUS CARPENTERI Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, pp. 303, 320; Univ. Cal. Zool. Publ., vol. 14, p. 276, pl. 25, fig. 10. Forrester Island to Gulf of California.

ANGULUS PANAMENSIS Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, p. 319, pl. 3, fig. 3.
Catalina Island, California, to Panama.

ANGULUS MODESTUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 639; Proc. Acad. Nat. Sci. Phila. for 1865, p. 54.
Vancouver Island to Lower California.

Subgenus OUDARDIA Monterosato, 1884.

OUDARDIA BUTTONI Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, p. 304, pl. 4, figs. 12, 13.
Lituya Bay, Alaska, to the Gulf of California.

Subgenus PERONIDIA Dall, 1900.

PERONIDIA BODEGENSIS Hinds, 1844.
Voy. *Sulphur*, Zool., p. 67, pl. 21, fig. 2.
Queen Charlotte Islands, British Columbia, to Gulf of California. Japan?

PERONIDIA SANTAROSAE Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, pp. 305, 321, pl. 3, fig. 6; pl. 4, figs. 1, 2.
Santa Barbara Islands and San Diego, California.

PERONIDIA LUTEA Gray, 1828.
Index Test. Suppl., pl. 1, *Tellina*, fig. 3.
Arctic Ocean, Bering Sea, North Japan, the Aleutian Islands and east to Cook's Inlet, Alaska.

PERONIDIA LUTEA VENULOSA Schrenck, 1861.
Bull. Imp. Akad. Sci. St. Petersburg, vol. 4, p. 412; Reise in Amurl., p. 556, pl. 22, figs. 2-5.
Shumagin Islands, Alaska; Sakhalin Island, Japan.

Genus METIS H. and A. Adams, 1856.

METIS ALTA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 258; Thes. Conch., *Tellina*, pl. 62, fig. 200.
Santa Barbara, California, to San Diego.

Genus MACOMA Leach, 1819.

MACOMA MIDDENDORFFII Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 347; vol. 9, p. 308, pl. 4, fig. 11.
Bering Strait, south to the Commander and Aleutian Islands and eastward to Chirikoff Island, Alaska.

MACOMA INCONGRUA Martens, 1865.
Ann. Mag. Nat. Hist., vol. 16, p. 430; Conch. Icon. *Tellina*, pl. 27, fig. 146.
Arctic Ocean, south to Japan on the west and to San Diego, California, on the east.

MACOMA BROTA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 413; Zool. Beechey's Voy. Moll., pl. 44, fig. 7.
Arctic Ocean. Bering Sea and south to Puget Sound.

MACOMA BROTA LIPARA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, p. 414.
Bering Sea to Puget Sound.

MACOMA SITKANA Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, pp. 307, 323, pl. 4, figs. 6, 7.
Kodiak Island to Lituya Bay and Sitka, Alaska.

MACOMA CALCAREA Gmelin, 1792.
Syst. Nat., vol. 7, p. 3236; Conch. Cab., ed. 1, vol. 6, p. 140, pl. 13, fig. 136.
Arctic Ocean to North Japan and to Monterey Bay, California. Circumboreal.

MACOMA MOESTA Deshayes, 1854.
Proc. Zool. Soc., p. 361; Proc. U. S. Nat. Mus., vol. 23, pl. 4, fig. 8.
Arctic Ocean, Bering Sea and eastward to the Shumagin Islands. Circumboreal.

MACOMA NASUTA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 258; Thes. Conch., *Tellina*, p. 314, pl. 64, fig. 224.
Kodiak Island and Cook's Inlet, Alaska, south to Scammon Lagoon, Lower California.

MACOMA INQUINATA Deshayes, 1854.
Proc. Zool. Soc., p. 357; Conch. Icon., *Tellina*, pl. 30, fig. 164.
Bering Strait to Japan on the west and to Monterey Bay, California, on the east.

MACOMA INQUINATA ARNHEIMI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 414.
Kodiak Island, Alaska, and south to San Francisco Pleistocene of San Pedro.

MACOMA BALTHICA Linnaeus, 1758.
Syst. Nat., ed. 10, p. 677; Thes. Conch., *Tellina*, pl. 59, fig. 121.
Circumboreal. Point Barrow, Arctic Ocean to North Japan and San Diego, California.

MACOMA INFLATULA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 11, pl. 1, figs. 19, 20.
Arctic Ocean and south to Ballenas Lagoon, Lower California.

MACOMA LEPTONOIDEA Dall, 1895.
Proc. U. S. Nat. Mus., vol. 23, pp. 308, 323, pl. 4, figs. 4, 9.
Santa Barbara Channel. Also Texas coast.

MACOMA ONEILLI Dall, 1919.
Sci. Res. Canadian Arctic Exp., vol. 8, pt. A., p. 20A, pl. 2, fig. 1.
Dolphin and Union Straits, Arctic Coast.

MACOMA KELSEYI Dall, 1900.
Trans. Wagner Inst., vol. 3, p. 1052, pl. 49, fig. 7.
Pleistocene, San Diego, California. Recent?

MACOMA QUADRANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 414.
Boca de Quadra, Alaska, and south to Coronado Islands, Lower California.

MACOMA CARLOTTENSIS Whiteaves, 1880.
Rep. Progress Geol. Surv. Canada, 1879–80, p. 196 B, fig. 1.
Arctic Ocean to Puget Sound.

MACOMA LIOTRICHA Dall, 1897.
Nat. Hist. Soc. Brit. Col., Bull. No. 2, p. 12, pl. 1, fig. 21.
Aleutian Islands and eastward to the Shumagin Islands, Alaska.

MACOMA EXPANSA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 639; Proc. Acad. Nat. Sci. Phila. for 1865, p. 56.
Puget Sound to La Jolla, California.

MACOMA YOLDIFORMIS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 639; Proc. Acad. Nat. Sci. Phila. for 1865, p. 55.—Arnold, Pal. San Pedro, pl. 16, fig. 6.
Fuca Strait to San Diego, California.

MACOMA TRUNCARIA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 414.
Island near Cape Halkett, Arctic Ocean.

MACOMA ALASKANA Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, p. 323, pl. 3, fig. 5.
Lituya Bay, to Gulf of Georgia.

Section REXITHAERUS Conrad, 1869.

MACOMA INDENTATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 639; Proc. Cal. Acad. Sci., vol. 3, p. 208.—Arnold, Pal. San Pedro, pl. 16, fig. 1.
Puget Sound to Lower California.

MACOMA INDENTATA TENUIROSTRIS Dall, 1900.
Proc. U. S. Nat. Mus., vol. 23, No. 1210, p. 324.
San Pedro and the Santa Barbara Islands, to San Diego (Kelsey).

MACOMA SECTA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 257; Thes. Conch., *Tellina*, pl. 65, figs. 245, 248.
Vancouver Island and south to the Gulf of California. Japan ?

Family SEMELIDAE.

Genus SEMELE Schumacher, 1817.

SEMELE DECISA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 239, pl. 19, fig. 2.
San Pedro to San Diego, California.

SEMELE STRIOSA C. B. Adams, 1852.
Panama Shells, p. 291.
Catalina Island, California, to Panama.

SEMELE RUPICOLA Dall, 1915.
Proc. Acad. Nat. Sci. Phila. for 1915, p. 26.
Santa Cruz, California, to Gulf of California.

SEMELE RUBROPICTA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 144, pl. 14, fig. 10.
Forrester Island, Alaska, to Tia Juana, Lower California.

SEMELE PACIFICA Dall, 1915.
Proc. Acad. Nat. Sci. Phila. for 1915, p. 27.
Catalina Island, California, to Acapulco.

SEMELE INCONGRUA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 640; Proc. Cal. Acad. Sci., vol. 3, p. 208.
Monterey, California, to the Coronado Islands.

SEMELE PULCHRA Sowerby, 1832.
Proc. Zool. Soc., p. 57; Conch. Ill., *Amphidesma*, fig. 2.
Monterey, California, to Ecuador.

Genus CUMINGIA Sowerby, 1833.

CUMINGIA LAMELLOSA Sowerby, 1833.
Proc. Zool. Soc., p. 34; Conch. Icon., *Cumingia*, pl. 1, fig. 5.
Crescent City, California, south to Payta, Peru.

Family DONACIDAE.

Genus DONAX Linnaeus, 1758.

DONAX CALIFORNICA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 254, pl. 19, fig. 1.
San Pedro, California, to Panama.

DONAX GOULDII Dall, 1919.
Boston Journ. Nat. Hist., vol. 6, p. 394 (as *obesus*), pl. 15, fig. 9.
Santa Barbara, California, to Acapulco.

DONAX PUNCTATOSTRIATA Hanley, 1843.
Proc. Zool. Soc., p. 5; Thes. Conch., *Donax*, p. 810, figs. 49, 50.
San Pedro, California, to Payta, Peru.

DONAX CONRADI Deshayes, 1854.
Proc. Zool. Soc., p. 351; Conch. Icon., *Donax*, pl. 5, fig. 29.
San Diego, California, to Central America.

Family PSAMMOBIIDAE.

Genus PSAMMOBIA Lamarck, 1818.

Subgenus GOBRAEUS Leach, 1852.

GOBRAEUS REGULARIS Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 312.
San Diego, California, to Cape San Lucas.

GOBRAEUS CALIFORNICUS Conrad, 1848.
Journ. Acad. Nat. Sci. Phila., vol. 7, pl. 19, fig. 3; Proc., vol. 4, p. 121.
Japan, Kamchatka, the Aleutian Islands and south to San Diego, California.

GOBRAEUS EDENTULUS Gabb, 1869.
Pal. Cal., vol. 2, p. 53, pl. 15, fig. 11.
San Pedro and Catalina Island, California, to San Diego. Also Pliocene of California.

Genus SANGUINOLARIA Lamarck, 1799.

Section NUTTALLIA Dall, 1897.

SANGUINOLARIA NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 230, pl. 17, fig. 6.
San Pedro to Magdalena Bay, Lower California. ?Japan.

Genus HETERODONAX Mörch, 1853.

HETERODONAX BIMACULATA Linnaeus, 1758.
Syst. Nat., ed. 10, p. 677; Conch. Icon., *Telling*, pl. 18, fig. 94.
Monterey, California, to Panama. Also Atlantic.

Genus TAGELUS Gray, 1847.

TAGELUS CALIFORNIANUS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 233, pl. 18, fig. 3.
Santa Barbara, California, to Gulf of Tehuantepec.

TAGELUS AFFINIS C. B. Adams, 1852.
Panama Shells, p. 300.
Santa Barbara, California, to Panama.

Section MESOPLEURA Conrad, 1837.

TAGELUS SUBTERES Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 233, pl. 17, fig. 10.
Santa Barbara, California, to Panama.

Superfamily SOLENACEA.

Family SOLENIDAE.

Genus SOLEN (Linnaeus) Scopoli, 1777.

SOLEN SICARIUS Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 214; Rep. U. S. Expl. Exp. Moll., p. 287, fig. 501.
Vancouver Island to San Quentin, Lower California.

SOLEN ROSACEUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 638; Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 177.
Santa Barbara, California, to Gulf of California.

Genus ENSIS Schumacher, 1817.

ENSIS CALIFORNICUS Dall, 1899.
Proc. U. S. Nat. Mus., vol. 22, p. 110.
Monterey, California, to Gulf of California.

Genus SILIQUA Megerle, 1811.

SILIQUA LUCIDA Conrad, 1837.
Journ. Acad. Nat. Sci., vol. 7, p. 231, pl. 17, fig. 8.
Monterey, California, to Todos Santos Bay, Lower California.

SILIQUA MEDIA Gray, 1839.
Zool. Beechey's Voy., p. 153, pl. 44, fig. 2.
Arctic Ocean and south to the Okhotsk Sea, Bering Sea, and eastward to Cooks Inlet, Alaska.

SILIQUA PATULA Dixon, 1788.
Dixon's Voy., p. 355, fig. 2.
The Okhotsk Sea, the southern border of Bering Sea and eastward to Sitka, Alaska.

SILIQUA PATULA ALTA Broderip and Sowerby, 1829.
Zool. Journ., vol. 4, p. 362.
Bering Strait, south to Unalaska and eastward to Kodiak Island, Alaska.

SILIQUA PATULA NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 232, pl. 17, fig. 9.
Lituya Bay, Alaska, and south to Monterey, California.

Superfamily MACTRACEA.

Family MACTRIDAE.

Genus ANATINA Schumacher, 1817.

ANATINA UNDULATA Gould, 1851.
Proc. Boston Soc. Nat. Hist., vol. 4, p. 89; Journal, vol. 4, pl. 15, fig. 7.
San Pedro, California, to Panama.

Genus MACTRA Linnaeus, 1758.

Subgenus MACTROTOMA Dall, 1894.

MACTROTOMA DOLABRIFORMIS Conrad, 1867.
Amer. Journ. Conch., vol. 3, p. 193; Nautilus, vol. 7, No. 12, p. 138, pl. 5, fig. 1.
Lobitas, California, to Topolobampo, Mexico.

MACTROTOMA CALIFORNICA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 340, pl. 18, fig. 12.
Neah Bay, Washington, to San Diego, California.

MACTROTOMA NASUTA Gould, 1851.
Proc. Boston Soc. Nat. Hist., vol. 4, p. 88.
San Diego, California. (West Colombia?)

Genus SPISULA Gray, 1838.

Subgenus HEMIMACTRA Swainson, 1840.

Section MACTROMERIS Conrad, 1868.

HEMIMACTRA (POLYNYMA Stimpson, var.) ALASKANA Dall, 1894.
Nautilus, vol. 8, No. 4, p. 40; Zool. Beechey's Voy. Moll., p. 154, pl. 44, fig. 8.
Arctic Ocean at Cape Lisburne, south to Bering Sea and the Aleutians and eastward to Puget Sound. North Japan, the Kuril Islands and the Okhotsk Sea (Schrenck).

HEMIMACTRA HEMPHILLI Dall, 1894.
Nautilus, vol. 7, No. 12, p. 137, pl. 5, fig. 2.
San Pedro to San Diego, California.

HEMIMACTRA CATILLIFORMIS Conrad, 1867.
Amer. Journ. Conch., vol. 3, p. 193; Nautilus, vol. 7, No. 12, p. 137, pl. 5, fig. 3.
Neah Bay to San Diego, California.

HEMIMACTRA FALCATA Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 216; Rep. U. S. Expl. Exp., Moll., p. 393, figs. 506 *a–b*.
Puget Sound to Cortez Bank and the Coronado Islands.

Subgenus SYMMORPHOMACTRA Dall, 1894.

SYMMORPHOMACTRA PLANULATA Conrad, 1837. (Plate 3, fig. 9.)
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 240.
Monterey to Cape San Lucas.

Genus SCHIZOTHAERUS Conrad, 1853.

SCHIZOTHAERUS NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 235, pl. 18, fig. 1; Bull. U. S. Fish Comm., vol. 3, No. 23, p. 354, fig. 1.
Wrangell, Alaska, to San Diego, California.

SCHIZOTHAERUS NUTTALLII CAPAX Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 217; Conch. Icon. *Mactra*, pl. 1, fig. 4.
Kodiak Island, Alaska, to San Francisco, California.

Family MESODESMATIDAE.

Genus ERVILIA Turton, 1822.

ERVILIA CALIFORNICA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 414.
San Pedro, California, to Magdalena Bay.

Superfamily MYACEA.

Family MYACIDAE.

Genus MYA (Linnaeus) Lamarck, 1799.

MYA TRUNCATA Linnaeus, 1758.
Syst. Nat., ed. 10, p. 670; Binney's Gould's Inv. Mass., p. 58, fig. 376.
Circumboreal. Arctic Ocean to Bering Island on the west and to Puget Sound on the east.

MYA INTERMEDIA Dall, 1898. (Plate 4.)
Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 857.
Arctic Ocean from Point Barrow to Monterey Bay, California.

MYA ARENARIA Linnaeus, 1758.
Syst. Nat., ed. 10, p. 670; Binney's Gould's Inv. Mass., p. 55, fig. 375.
Introduced at San Francisco with "seed" oysters from the Atlantic coast. Spread from Victoria, British Columbia, to Monterey, California.

Genus CRYPTOMYA Conrad, 1849.

CRYPTOMYA CALIFORNICA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 234, pl. 17, fig. 11.
Chichagoff Island, Alaska, and south to Topolobampo, Mexico.

Genus SPHENIA Turton, 1822.

SPHENIA FRAGILIS Carpenter, 1857.
Mazatlan Cat., p. 24, No. 35.
Oregon to Mazatlan.

SPHENIA OVOIDEA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 637; Proc. Acad. Nat. Sci. Phila. for 1865, p. 54.
Aleutian Islands to Puget Sound and San Diego.

SPHENIA TRUNCULUS Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 415.
San Diego, California, to Panama.

SPHENIA PHOLADIDEA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 415.
Santa Barbara, California.

SPHENIA GLOBULA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 570.
Monterey, California.

Genus PLATYODON Conrad, 1837.

PLATYODON CANCELLATUS Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, 236, pl. 18, fig. 2.
Baulinas Bay, California, to San Diego, California.

Family CORBULIDAE.

Genus CORBULA Bruguière, 1792.

CORBULA OBESA Hinds, 1843.
Proc. Zool. Soc., p. 57; Zool. *Sulphur's* Voy., Moll., p. 68, pl. 20, fig. 12.
Catalina Island, California, to Panama.

CORBULA FRAGILIS Hinds, 1843.
Proc. Zool. Soc., p. 56; Zool. *Sulphur's* Voy., Moll., p. 68, pl. 20, fig. 11.
Monterey, California, to Salina Cruz, Mexico.

CORBULA LUTEOLA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 637; Proc. Cal. Acad. Sci., vol. 3, p. 207.—Arnold, Pal. San Pedro, p. 181, pl. 17, fig. 11.
Monterey, California, to Magdalena Bay.

CORBULA PORCELLA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 415.
Santa Rosa Island, California, to Panama.

CORBULA KELSEYI Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 416.
Esteros Bay, to Catalina Island, California.

Genus GRIPPINA Dall, 1912.

GRIPPINA CALIFORNICA Dall, 1912.
Nautilus, vol. 25, No. 11, p. 128.
Off San Diego Bay, California.

Family SAXICAVIDAE.

Genus PANOPE Menard, 1807.

PANOPE GENEROSA Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 215; Bull. U. S. Fish. Com., vol. 3, No. 23, p. 356, figs. 3—6, 1883.
Puget Sound to San Diego, California.

PANOPE GENEROSA SOLIDA Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 831.
Straits of Fuca to San Francisco Bay.

Genus PANOMYA (Gray) Adams, 1858.

PANOMYA (ARCTICA Lamarck, 1819, ?variety) TURGIDA Dall, 1916. (Plate 2, fig. 1.)
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 416.
Unalaska to the Shumagin Islands, Alaska.

PANOMYA BERINGIANA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 415.
Eastern Bering Sea.

PANOMYA AMPLA Dall, 1898.
Trans. Wagner Inst., vol. 3, pt. 4, p. 833; Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 560, pl. 40, figs. 3, 4.
Arctic Ocean north of Bering Strait, Bering Sea, Aleutian Islands and eastward to Victoria, British Columbia.

Genus SAXICAVELLA Martens, 1885.

SAXICAVELLA PACIFICA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 416.
Off Point Loma, San Diego, 131 fathoms.

Genus CYRTODARIA Daudin, 1799.

CYRTODARIA KURRIANA Dunker, 1862.
Malak. Blätt. 1862, p. 38.—POSSELT, Consp. Fauna Grönl., p. 96.
Arctic Ocean and south to Norton Sound, Alaska. Also on the west coast of Greenland.

Genus SAXICAVA Fleuriau, 1802.

SAXICAVA ARCTICA Linnaeus, 1767.
Sys. Nat., ed. 12, p. 1113; Thes. Conch., *Saxicava*, pl. 471, fig. 1.—Sars, Moll. Reg. Arct. Norv., pl. 20, figs. 8 *a–b*. (*yo.*).
Arctic Ocean to Panama. Also Atlantic.

SAXICAVA PHOLADIS Linnaeus, 1771.
Mantissa, vol. 2, p. 548.—Sars, Moll. Reg. Arct. Norv., pl. 20, figs. 7 *a–b*.
Arctic Ocean to Panama. Also Atlantic.

Superfamily ADESMACEA.

Family PHOLADIDAE.

Subfamily PHOLADINAE.

Genus BARNEA (Leach) Risso, 1826.

BARNEA PACIFICA Stearns, 1871.
Prel. Descr., Aug. 1871, p. 1; Proc. Cal. Acad. Sci., vol. 5, p. 81, pl. 1, figs. 6, 6 *a–c.*, 1873.
San Francisco Bay to Lower California.

Genus ZIRFAEA (Leach) Gray, 1847.

ZIRFAEA GABBI Tryon, 1863.
Proc. Acad. Nat. Sci. Phila. for 1863, p. 144, pl. 1, fig. 1.
Bering Sea and islands and south to San Diego, California.

Subfamily JOUANNETINAE.

Genus PARAPHOLAS Conrad, 1848.

PARAPHOLAS CALIFORNICA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 236, pl. 18, fig. 5.
Monterey to San Diego, California.

Genus PHOLADIDEA Turton, 1819.

PHOLADIDEA PENITA Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 237, pl. 18, fig. 7.
Chirikoff Islands, Alaska, and south to San Diego, California.

PHOLADIDEA PENITA CONCAMERATA Deshayes, 1839.
Rev. Zool. Soc. Cuvierienne, p. 324.—Guérin, Mag. Zool. 1840, Moll., pl. 17.
Bering Sea and islands and south to San Diego, California.

PHOLADIDEA PENITA SAGITTA Stearns, 1916.
Proc. U. S. Nat. Mus., vol. 52, No. 2183, p. 417.
Puget Sound to Socorro Island.

PHOLADIDEA MELANURA Sowerby, 1834.
Proc. Zool. Soc., p. 70; Thes. Conch. *Pholas*, pl. 107, figs. 78, 79.
Redondo, California, 40 fathoms.

PHOLADIDEA OVOIDEA Gould, 1851.
Proc. Boston Soc. Nat. Hist., vol. 4, p. 87; Boston Journ. Nat. Hist., vol. 6, p. 388, pl. 15, fig. 1.
Bering Sea and islands and south to the Gulf of California.

PHOLADIDEA PARVA Tryon, 1865.
Amer. Journ. Conch., vol. 1, p. 39, pl. 2, figs. 4, 5.
San Pedro, California, to Lower California, in shells of *Haliotis*.

Subgenus NETTASTOMELLA Carpenter, 1865.

NETTASTOMELLA ROSTRATA Valenciennes, 1846.
Voy. *Venus*, Atlas, pl. 24, figs. 4, 4*a*.
Puget Sound to San Diego, California.

Genus MARTESIA (Leach) Blainville, 1824.

MARTESIA XYLOPHAGA Valenciennes, 1846.
Voy. *Venus*, Atlas, pl. 24, fig. 2.
San Francisco, California, to Panama.

MARTESIA INTERCALATA Carpenter, 1855.
Mazatlan Cat., No. 19, p. 13.
Farallones Islands to Mazatlan, Mexico.

Genus NAVEA Gray, 1851.

NAVEA SUBGLOBOSA Gray, 1851.
Ann. Mag. Nat. Hist., ser. 2, vol. 8, p. 385.—CHENU, Man., vol. 2, p. 6, figs. 28, 29.
Lobitas to Monterey, California.

Genus XYLOPHAGA Turton, 1822.

XYLOPHAGA MEXICANA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 425.
Puget Sound to Acapulco.

Family TEREDIDAE.

Genus BANKIA Gray, 1842.

BANKIA?, species.
Bering Island, Bering Sea.

BANKIA SETACEA Tryon, 1863.
Proc. Acad. Nat. Sci. Phila., p. 144, pl. 1, figs. 2, 3.
Bering Sea to Gulf of California.

Genus TEREDO Linnaeus, 1758.

TEREDO DIEGENSIS Bartsch, 1916.
Nautilus, vol. 30, No. 4, p. 48.
San Diego, California, to San Francisco Bay.

Class SCAPHOPODA.

Order SOLENOCONCHA.

Family DENTALIIDAE.

Genus DENTALIUM Linnaeus, 1758.

DENTALIUM INVERSUM Deshayes, 1825.
Mem. Soc. Hist. Nat., Paris, vol. 2, p. 270, pl. 16, figs. 21, 22.
Bering Sea to Panama in increasingly deep water.

DENTALIUM NEOHEXAGONUM Sharp and Pilsbry, 1897.
Man. Conch., vol. 17, p. 19, pl. 11, figs. 74–86.
Monterey to Guacomayo, Central America.

DENTALIUM SEMIPOLITUM Broderip and Sowerby, 1829.
Zool. Journ., vol. 4, p. 369.—PILSBRY, Man. Conch., vol. 17, pl. 16, fig. 54.
San Pedro, California, to Mazatlan, Mexico.

DENTALIUM DALLI Pilsbry and Sharp, 1897.
Man. Conch., vol. 17, pl. 21, fig. 46.
Pribilof Islands, Bering Sea, to Point Aguja, Peru.

DENTALIUM RECTIUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., for 1863, p. 648.—PILSBRY, Man. Conch., vol. 17, pl. 21, fig. 45.
Stephens Passage, Alaska, to Panama Bay.

DENTALIUM WATSONI Sharp and Pilsbry, 1897.
Man. Conch., vol. 17, p. 113, pl. 21, fig. 44.
Tillamook, Oregon, to San Diego, California.

DENTALIUM (OERSTEDTII Mörch, var.?) NUMEROSUM Dall, 1897.
PILSBRY, Man. Conch., vol. 17, p. 25, pl. 10, figs. 70–73.
Coronado Islands and south to Panama and the Galapagos Islands, in deep water.

DENTALIUM AGASSIZII Pilsbry and Sharp, 1897.
Man. Conch., vol. 17, p. 26, pl. 12, figs. 90–94.
Santa Barbara Islands, California, to Panama.

DENTALIUM FISHERI (Stearns) Pilsbry, 1897.
Man. Conch., vol. 17, p. 36, pl. 5, figs. 61–65.
Los Animas Bay, California, to Gulf of California.

DENTALIUM VALLICOLENS Raymond, 1904.
Nautilus, vol. 17, p. 123.
Fuca Strait to Gulf of California.

DENTALIUM PRETIOSUM Sowerby, 1860.
Thes. Conch., p. 95, pl. 225, fig. 57.
Forrester Island, Alaska, to San Diego, California.

Genus SIPHONODENTALIUM M. Sars, 1859.

? SIPHONODENTALIUM QUADRIFISSATUM Pilsbry, 1898.
Man. Conch., vol. 17, p. 150, pl. 29, figs. 10–13.
San Pedro to San Diego, California.

Genus CADULUS Philippi, 1844.

CADULUS FUSIFORMIS Pilsbry and Sharp, 1898.
Man. Conch., vol 17, p. 193, pl. 35, fig. 14.
Monterey, California, to Cape San Lucas.

CADULUS HEPBURNI Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 12, pl. 1, fig. 13.
Victoria, British Columbia, to Monterey, California.

CADULUS CALIFORNICUS Pilsbry and Sharp, 1898.
Man. Conch., p 17, vol. 180, pl. 34, figs. 5–8.
Clarence Strait, Alaska, to Manta, Ecuador.

CADULUS TOLMEI Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 13, pl. 1, fig. 8.
Vancouver Island to San Quentin Bay, Lower California.

CADULUS PERPUSILLUS Sowerby, 1832.
Proc. Zool. Soc., 1832, p. 29.
Monterey, California, to Panama.

CADULUS ABERRANS Whiteaves, 1887.
Trans. Roy. Soc. Canada, vol. 4, sec. 4, p. 124, fig. 2.
Quatsino Sound, British Columbia.

CADULUS STEARNSII Pilsbry and Sharp, 1898.
Man. Conch., vol. 17, p. 253, pl. 27, figs. 88, 89.
British Columbia to San Quentin Bay, Lower California.

Class GASTROPODA.

Subclass ANISOPLEURA.

Superorder EUTHYNEURA.

Order PTEROPODA.

Suborder THECOSOMATA.

Family SPIRATELLIDAE.

Genus SPIRATELLA Blainville, 1817.

SPIRATELLA PACIFICA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 138.
Point Barrow, Arctic Ocean, south to Monterey, California.

Subgenus HETEROFUSUS Fleming, 1823.

HETEROFUSUS, species.
Off Oregon coast, in stomach of salmon.

Family CAVOLINIIDAE.

Genus CAVOLINA Abildgaard, 1791.

CAVOLINA OCCIDENTALIS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 233, pl. 12, fig. 1.
Northeast Pacific between latitudes 30° and 54° north.

Genus CLIO Linnaens, 1767.

CLIO EXACUTA Gould, 1852.
U. S. Expl. Exp. Shells, p. 488, pl. 51, fig. 605.
North Pacific Ocean west of Columbia River.

CLIO OCCIDENTALIS Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 140.
Northeast Pacific between latitudes 30° and 50° north.
Off the Farallone Islands in the stomach of *Orthagoriscus mola.*

Genus SPYLIOLA Lesueur, 1826.

STYLIOLA FALCATA Gould, 1852.
U. S. Expl. Exp. Shells, p. 490, pl. 51, fig. 608.
Northeast Pacific, west of Oregon.

Genus CRESEIS Rang, 1828.

CRESEIS SUBULA Quoy and Gaimard, 1827.
Ann. Sci. Nat., vol. 13, p. 313, pl. 17, fig. 1.
Warmer waters of the north Pacific.

Family CYMBULLIDAE.

Genus COROLLA Dall, 1871.

COROLLA SPECTABILIS Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 138; Zool. Jahrb., vol. 20, Heft 1, p. 67, pl. 5, 1904.
North Pacific Ocean from Monterey to latitude 43° north. Japan seas.

Suborder GYMNOSOMATA.

Family CLIONIDAE.

Genus CLIONE Pallas, 1774.

CLIONE LIMACINA Phipps, 1773.
Voy. N. Pole, p. 195.—PALLAS, Spic. Zool., pl. 1, figs. 18–19, 1774.
Circumboreal. Northern Bering Sea south to the Pribilof Islands, rarely to the Aleutians.

CLIONE ELEGANTISSIMA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 139.
South of the Aleutian Islands, in latitude 51° 50′, longitude 161° 26′ west.

Family PNEUMODERMATIDAE.

Genus PNEUMODERMA Péron and Lesueur, 1810.

PNEUMODERMA PACIFICA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 139, *Challenger* Pteropoda, pl. 2, figs. 4, 5.
Northeast Pacific, off the California coast in latitude 37° and northward to latitude 45°

Family DESMOPTERIDAE.

Genus DESMOPTERUS Chun, 1889.

DESMOPTERUS PACIFICUS Essenberg, 1919.
Univ. of Cal. Pub. Zool., vol. 19, No. 2, p. 85, figs. 1, 2.
Off Southern California.

Order OPISTHOBRANCHIATA.

Suborder TECTIBRANCHIATA.

(CEPHALASPIDEA.)

Family ACTEONIDAE.

Genus ACTEON Montfort, 1810.

ACTEON TRASKI Stearns, 1898.
Proc. U. S. Nat. Mus., vol. 21, No. 1145, p. 298, fig. 1.
San Diego, California, to Panama. Also Pleistocene.

Subgenus RICTAXIS Dall, 1871.

RICTAXIS PUNCTOCOELATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 646; Amer. Journ. Conch., vol. 7, pl. 15, fig. 12.
Monterey, California, to Magdalena Bay, Lower California.

RICTAXIS PAINEI Dall, 1903. **(Plate 3, fig. 5.)**
Proc. Biol. Soc. Wash., vol. 16, p. 172.
Catalina Island, California, in 50 fathoms.

Genus MICROGLYPHIS Dall, 1902.

MICROGLYPHIS BREVICULUS Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 512; Bull. Mus. Comp. Zool., vol. 43, pl. 15, fig. 12.
Monterey, California, to Point San Quentin, Lower California.

MICROGLYPHIS ESTUARINUS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6. p. 238.
Straits of Fuca to Gulf of California.

Family ACTEOCINIDAE.

Genus ACTEOCINA Gray, 1847.

ACTEOCINA CULCITELLA Gould, 1852.
Boston Journ. Nat. Hist., vol. 6, p. 377, pl. 14, fig. 8.
Kodiak Island, Alaska, south to Puget Sound.

ACTEOCINA EXIMIA Baird, 1863.
Proc Zool. Soc., p. 67.
Kodiak Island, Alaska, south to Puget Sound.

ACTEOCINA SMIRNA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 296.
San Diego, California, to San Salvador.

ACTEOCINA INCULTA Gould, 1856.
Proc. Zool. Soc., p. 203; Man. Conch., vol. 15, pl. 59, fig. 15.
Monterey, California, to Gulf of California.

ACTEOCINA INFREQUENS C. B. Adams, 1852.
Panama Shells, p. 214.
Santa Monica, California, to Panama.

ACTEOCINA CARINATA Carpenter, 1857.
Mazatlan Cat., p. 171.
San Diego, California, to Gulf of California.

ACTEOCINA PLANATA Carpenter, 1865.
Journ. de Conchyl., vol. 13, p. 139.
San Diego, California.

Genus RETUSA Brown, 1827.

RETUSA SEMEN Reeve, 1856.
Last of the Arctic Voy., vol. 2, p. 393, pl. 32, fig. 4.
Off Point Collinson, Arctic Ocean. Also Atlantic.

RETUSA OBTUSA Montagu, 1803.
Test. Brit., vol. 1, p. 223, pl. 7, fig. 3.
Arctic Ocean to St. Mathew Island. Circumboreal.

RETUSA PERTENUIS Mighels, 1843.
Boston Journ. Nat. Hist., vol. 4, p. 346, pl. 16. fig. 3.
Arctic Ocean; Bering Sea (Krause). Also Atlantic.

Section COLEOPHYSIS Fischer, 1883.

RETUSA HARPA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 136, pl. 15, fig. 11.
Queen Charlotte Islands, British Columbia, to San Diego, California.

Section SULCULARIA Dall, 1920.

RETUSA XYSTRUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56. No. 2295, p. 297.
San Pedro to San Diego, California.

Genus VOLVULELLA Newton, 1891.

VOLVULELLA CYLINDRICA Carpenter, 1863.
Suppl. Rep. Brit. Assoc., p. 647; Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 179, 1865.
Vancouver Island south to Gulf of California.

VOLVULELLA COOPERI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 297.
Point Sur, California, to Scammon Lagoon, Lower California.

VOLVULELLA CALIFORNICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 298.
Santa Rosa Island to San Diego, California.

Family SCAPHANDRIDAE.

Genus SCAPHANDER Montfort, 1810.

SCAPHANDER WILLETTI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 299.
Forrester Island, Alaska.

Genus ATYS Montfort, 1810.

ATYS CASTA Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 314.
Catalina Island to Gulf of California.

ATYS NONSCRIPTA A. Adams, 1850.
Thes. Conch., p. 588, pl. 125, fig. 125.
San Diego, California (Carpenter).

Genus DIAPHANA Brown, 1827.

DIAPHANA BRUNNEA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 299.
Kodiak Island, Alaska.

DIAPHANA CALIFORNICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 299.
San Pedro, California, to South Coronado Island.

DIAPHANA GLOBOSA Lovèn, 1846.
Index Moll. Scand., p. 11.—Sars, Moll. Reg. Arct. Norv., pl. 18, fig. 4.
Bering Strait and Arctic Ocean. Circumboreal (Krause).

Genus BROCKTONIA Iredale, 1915.

BROCKTONIA POLYSTRIGMA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 246.
San Diego, California.

Genus CYLICHNELLA Gabb, 1872.

Subgenus BULLINELLA Newton, 1891.

BULLINELLA ALBA Brown, 1827.
Ill. Conch. Gt. Brit., p. 8, pl. 19, figs. 43, 44.
Circumboreal. Arctic Ocean to Monterey. Also Pleistocene of San Diego, California.

BULLINELLA NUCLEOLA Reeve, 1855.
Last of the Arctic Voy., vol. 2, p. 393, pl. 32, fig. 2.
Grantley Harbor, Port Clarence, Bering Strait. Circumboreal.

BULLINELLA OCCULTA Mighels, 1841.
Proc. Boston Soc. Nat. Hist., vol. 1, p. 50; Boston Journ. Nat. Hist., vol. 4, pl. 4, fig. 11.
Circumboreal. Point Barrow to Aleutian Islands.

BULLINELLA DIEGENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 300.
San Diego, California, to Cape San Lucas. Vancouver Island?

BULLINELLA ATTONSA Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 58.
San Diego, California.

Family BULLARIIDAE.

Genus BULLARIA Rafinesque, 1815.

BULLARIA GOULDIANA Pilsbry, 1893.
Man. Conch., vol. 15, p. 340, pl. 36, figs. 22–24.
Santa Barbara, California, to Mazatlan, Mexico.

BULLARIA QUOYANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 300; Man. Conch., vol. 15, pl. 37, fig. 39.
Catalina Island, California, to Acapulco, Mexico.

Family AKERIDAE.

Genus HAMINOEA Turton, 1830.

HAMINOEA VIRESCENS Sowerby, 1833.
Genera of Shells, *Bulla*, fig. 2.
Santa Barbara, California, to Puerto Libertad, Mexico.

HAMINOEA VESICULA Gould, 1855.
Pacific R. R. Surveys, vol. 5, app. p. 334, pl. 5, fig. 29.
Vancouver Island to Gulf of California.

HAMINOEA OLGAE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 300.
Olga, Washington, to San Quentin Bay, Lower California.

Family PHILINIDAE.

Genus PHILINE Ascanius, 1772.

PHILINE SINUATA Stimpson, 1850.
Shells of New England, p. 51, pl. 1, fig. 7.
Port Clarence, Bering Strait; (Krause). Also Atlantic.

PHILINE POLARIS Aurivillius, 1885.
Vega Exp. Arb., vol. 4, p. 380, pl. 12, figs. 21, 22; pl. 13, fig. 18.
Arctic Sea to Nanaimo, British Columbia.

PHILINE BAKERI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 300.
Off the South Coronado Island near San Diego, California.

Family GASTROPTERIDAE.

Genus GASTROPTERON Kosse, 1813.

GASTROPTERON PACIFICUM Bergh, 1893.
Zool. Jahrb., vol. 7, p. 303, pl. 16, fig. 28.
Aleutian Islands to Fuca Strait.

Family AGLAJIDAE.

Genus AGLAJA Renier, 1804.

AGLAJA PURPUREA Bergh, 1894.
Bull. Mus. Comp. Zool., vol. 25, p. 209, pl. 12, fig. 7.
Catalina Island, California.

AGLAJA DIOMEDEA Bergh, 1894.
Bull. Mus. Comp. Zool., vol. 25, p. 211, pl. 11, fig. 1.
Shumagin and Kodiak Islands, Alaska.

AGLAJA OCELLIGERA Bergh, 1894.
Bull. Mus. Comp. Zool., vol. 25, p. 212, pl. 10, fig. 10.
Sitka Harbor, Alaska.

AGLAJA ADELLAE Dall, 1894.
Nautilus, vol. 8, p. 73; Man. Conch., vol. 16, pl. 9, figs. 17–22.
Eagle Harbor, Puget Sound, in 20 fathoms.

Genus NAVANAX Pilsbry, 1895.

NAVANAX INERMIS Cooper, 1862.
Proc. Cal. Acad. Sci., vol. 2, p. 202; Man. Conch., vol. 16, pl. 15, figs. 89–93.
Catalina Island to San Diego, California.

(ANASPIDEA.)

Family APLYSIIDAE.

Genus TETHYS Linnaeus, 1758.

Section NEAPLYSIA Cooper, 1863.

TETHYS CALIFORNICA Cooper, 1863.
Proc. Cal. Acad. Sci., vol. 3, p. 57, fig. 14.
Monterey to San Pedro, California.

TETHYS RITTERI Cockerell, 1901.
Nautilus, vol. 15, p. 90.
San Pedro, California.

(NOTASPIDEA.)

Family TYLODINIDAE.

Genus TYLODINA Rafinesque, 1819.

TYLODINA FUNGINA Gabb, 1865. (Plate 15, figs. 15, 16, 17.)
Proc. Cal. Acad. Sci., vol. 3, p. 188.
Santa Barbara Islands, San Pedro, and San Diego, California.

Family PLEUROBRANCHIDAE.

Genus PLEUROBRANCHUS Cuvier, 1804.

PLEUROBRANCHUS CALIFORNICUS Dall, 1900.
Nautilus, vol. 14, p. 92.
San Pedro to San Diego, California.

PLEUROBRANCHUS DIGUETI Rochebrune, 1895.
Bull. Mus. Hist. Nat. Paris, p. 240; Man. Conch., vol. 16, pl. 54, figs. 98, 99, 1, 2.
San Pedro, California, to Gulf of California.

Order NUDIBRANCHIATA.

(Omitted.)

[For data on this group see Cooper and Stearns in Proceedings of the California Academy of Sciences; Macfarland in Proceedings of the Biological Society of Washington, 1905, in the Bulletin of the United States Bureau of Fisheries, 1905, and the Nautilus, June, 1908; also Bergh in Proceedings of the Academy of Natural Sciences, Philadelphia, 1879–80, and other papers.]

Order PULMONATA.

Suborder BASOMMATOPHORA.

Superfamily AKTEOPHILA.

Family ELLOBIIDAE.

Genus PHYTIA Gray, 1821.

PHYTIA SETIFER Cooper, 1872.
Proc. Cal. Acad. Sci., vol. 4, p. 172.
Humboldt Bay to San Francisco Bay.

Genus PEDIPES Scopoli, 1777.

PEDIPES UNISULCATUS Cooper, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 294, fig. 29.
San Pedro, California, to the Gulf of California.

PEDIPES LIRATUS Binney, 1869.
Proc. Acad. Nat. Sci., Phila., p. 154; Proc. U. S. Nat. Mus., vol. 8, p. 279, pl. 18, fig. 5.
San Diego, California, to the Gulf of California.

Genus MELAMPUS Montfort, 1810.

MELAMPUS OLIVACEUS Carpenter, 1856.
Mazatlan Cat., p. 178; Proc. U. S. Nat. Mus., vol. 8, pl. 18, fig. 16.
Monterey Bay (Salinas River) to Mazatlan, Mexico.

Superfamily PETROPHILA.

Family GADINIIDAE.

Genus GADINIA Gray, 1824.

GADINIA RETICULATA Sowerby, 1835.
Proc. Zool. Soc., p. 6; Amer. Journ. Conch., vol. 6, pl. 2, 4, 1870.
Trinidad and Farallones Islands to Cape San Lucas.

Family SIPHONARIIDAE.

Genus SIPHONARIA Sowerby, 1824.

Subgenus LIRIOLA Dall, 1870.

LIRIOLA THERSITES Carpenter, 1864.
Ann. Mag. Nat. Hist., vol. 14, p. 425; Amer. Journ. Conch., vol. 6, pl. 4, fig. 8; pl. 5, fig. 2, 1870.
Aleutian Islands to the Strait of Fuca.

Subgenus Kerguelenia Rochebrune and Mabille, 1889.

KERGUELENIA BRANNANI Stearns, 1872. (Plate 15, figs. 13, 14.)
Proc. Cal. Acad. Sci., vol. 4, p. 249. pl. 1, fig. 4.
Santa Barbara and Santa Catalina Islands; Laguna Beach, California.

Genus WILLIAMIA Monterosato, 1884.

WILLIAMIA VERNALIS Dall, 1870.
Amer. Journ. Conch., vol. 6, p. 37, pl. 4, figs. 11 *a–b*, 1870; Journ. de Conch., vol. 26, p. 70.
Crescent City to San Nicolas Island, and La Jolla, California.

WILLIAMIA PELTOIDES Carpenter, 1864. (Plate 15, figs. 10, 12.)
Ann. Mag. Nat. Hist., vol. 50, p. 474.
Catalina Island to Gulf of California.

Suborder STYLOMMATOPHORA

Superfamily DITREMATA.

Family ONCHIDIIDAE.

Genus ARCTONCHIS Dall, 1905.

ARCTONCHIS BOREALIS Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 135; Proc. Acad. Nat. Sci. Phila., 1876, pl. 6, fig. E.
Port Moller and Aleutian Islands to northern California.

Superorder STREPTONEURA.

Order CTENOBRANCHIATA.

Suborder ORTHODONTA.

Superfamily TOXOGLOSSA.

Family TEREBRIDAE.

Genus TEREBRA (Bruguière, 1789) Lamarck, 1799.

Subgenus Strioterebrum Sacco, 1891.

STRIOTEREBRUM PEDROANUM Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 251.
San Pedro and San Diego, California.

STRIOTEREBRUM PEDROANUM PHILIPPIANUM Dall, 1920.
Carpenter, Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 394, 1865. (*Simplex* Carpenter, not Conrad, 1830.)
San Pedro, California, to head of Gulf of California.

Family CONIDAE.

Genus CONUS Linnaeus, 1758.

CONUS CALIFORNICUS Hinds, 1844. (Plate 14, fig. 9.)
Zool. Voy. *Sulphur*, Moll. p. 6, pl. 1, figs. 3–5.
Farallones Islands, California, to Ballenas Lagoon, Lower California.

Family TURRITIDAE.

Subfamily TURRITINAE.

Genus CRYPTOCONUS von Koenen, 1867.

CRYPTOCONUS TRYONIANUS Gabb, 1866.
Pal. Cal., vol. 2, p. 6, pl. 1, fig. 9.
San Pedro, California, to Todos Santos Bay, Lower California.

CRYPTOCONUS CARPENTERIANUS Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 183; Pal. Cal., vol. 2, pl. 1, fig. 8.
Bodega Bay to San Pedro. Fossil at San Diego, California.

CRYPTOCONUS TREMPERIANUS Dall, 1911. (Plate 12, fig. 5.)
Nautilus, vol. 24, No. 10, p. 109.
Point Ano Nuevo, California, to Cerros Island.

CRYPTOCONUS STEARNSIANUS Raymond, 1904.
Nautilus, vol. 18, p. 1.
Monterey to San Diego, California.

Genus AFORIA Dall, 1889.

AFORIA CIRCINATA Dall, 1873. (Plate 11, fig. 6.)
Proc. Cal. Acad. Sci., vol. 5, p. 61, pl. 2, fig. 5.
Bering Sea (lat. 62° 29′) to Fuca Strait.

Genus LEUCOSYRINX Dall, 1889.

LEUCOSYRINX KINCAIDI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2288, p. 6, pl. 2, fig. 8.
Shelikoff Strait, Alaska.

LEUCOSYRINX AMYCUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 53, p. 5, pl. 3, fig. 7.
Off Monterey, California, in 871 fathoms.

LEUCOSYRINX PERSIMILIS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 271, pl. 12, fig. 2.
Abyssal, eastern Pacific.

LEUCOSYRINX PERSIMILIS BLANCA Dall, 1919.
Proc U. S. Nat. Mus., vol. 56, p. 5.
Off Cape Blanco, Oregon, in 1,064 fathoms.

LEUCOSYRINX PERSIMILIS LEONIS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 272.
Off Sealion Rock, Washington, to Cortez Bank, California, in deep water.

Genus IRENOSYRINX Dall, 1889.

IRENOSYRINX PACIFICA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 270, pl. 12, fig. 3.
Southwest of Sitka, Alaska, in 1,509 fathoms.

? IRENOSYRINX CREBRISTRIATA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 272, pl. 13, fig. 10.
Southwest of Sitka, Alaska, in 1,509 fathoms.

Genus CYMATOSYRINX Dall, 1889.

Subgenus ELAEOCYMA Dall, 1917.

ELAEOCYMA JOHNSONI Arnold, 1903.
Pal. San Pedro, p. 206, pl. 8, fig. 17.
San Pedro, California. Pleistocene.

ELAEOCYMA EMPYROSIA Dall, 1899.
Nautilus, vol. 12, p. 127; Proc. U. S. Nat. Mus., vol. 56, pl. 4, fig. 1.
San Pedro to San Diego, California.

ELAEOCYMA HEMPHILLI Stearns, 1871.
Proc. Cal. Acad. Sci., vol. 5, p. 80, pl. 1, fig. 3.
Santa Barbara to the Gulf of California.

ELAEOCYMA HALOCYDNE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 11, pl. 4, fig. 4.
San Pedro and the Santa Barbara Islands, California.

Genus CLATHRODRILLIA Dall, 1918.

CLATHRODRILLIA RENAUDI Arnold, 1903.
Pal. San Pedro, p. 208, pl. 8, fig. 5.
San Pedro, California. Also Pleistocene.

Section CARINODRILLIA Dall, 1911.

CLATHRODRILLIA, species.
Off Santa Rosa Island, California, in 53 fathoms.

Subgenus SUAVODRILLIA Dall, 1918.

SUAVODRILLIA KENNICOTTII Dall, 1871. **(Plate 11, fig. 7.)**
Amer. Journ. Conch., vol. 7, p. 102, pl. 16, fig. 2.
Bering Strait south to the Aleutian Islands.

? SUAVODRILLIA WILLETTI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 29.
Forrester Island, Alaska.

Subgenus MONILIOPSIS Conrad, 1865.

MONILIOPSIS GRIPPI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 27, pl. 8, fig. 2.
San Diego, California.

MONILIOPSIS INCISA Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 62; Proc. U. S. Nat. Mus., vol. 56, pl. 12, fig. 7.
Puget Sound to San Pedro, California.

MONILIOPSIS INCISA OPHIODERMA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 247.—HINDS, Voy. *Sulphur*, Zool., pl. 5, fig. 7, 1844.
Baulinas Bay, California, to Ballenas Lagoon, Lower California.

MONILIOPSIS RHINES Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 248; vol. 56, pl. 8, fig. 5, 1919.
Puget Sound to San Diego, California.

MONILIOPSIS HALCYONIS Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 248; vol. 56, pl. 8, fig. 1, 1919.
Burrard Inlet to San Diego, California.

MONILIOPSIS FANCHERAE Dall, 1903. (Plate 6, fig. 3.)
Proc. Biol. Soc. Wash., vol. 16, p. 172; Proc. U. S. Nat. Mus., vol. 56, pl. 8, fig. 3, 1919.
Santa Rosa Island, California, to Point Abreojos, Lower California

Genus PSEUDOMELATOMA Dall, 1918.

PSEUDOMELATOMA MOESTA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 399.—TRYON, Man., vol. 6, pl. 12, fig. 38.
Monterey, California, to Cerros Island, Lower California.

PSEUDOMELATOMA TOROSA Carpenter, 1865.
Journ. de Conchyl., vol. 13, p. 145.—TRYON, Man., vol. 6, pl. 14, fig. 93,
Monterey, California, to Scammon Lagoon, Lower California.

PSEUDOMELATOMA TOROSA AURANTIA Carpenter, 1865.
Journ. de Conchyl., vol. 13, p. 145.
Monterey to San Diego, Cal.

Genus CRASSISPIRA Swainson, 1840.

CRASSISPIRA MONTEREYENSIS Stearns, 1871.
Proc. Cal. Acad. Sci., vol. 5, p. 80, pl. 1, fig. 2.
Monterey, California, to Mazatlan, Mexico.

Genus CRYPTOGEMMA Dall, 1917.

CRYPTOGEMMA PERNODATA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 266.
Tillamook Bay, Oregon, to Tehuantepec in deep water.

CRYPTOGEMMA CALYPSO Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 31, pl. 9, fig. 8.
Off San Diego, California, in 822 fathoms.

CRYPTOGEMMA HERILDA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 266.
Santa Barbara, California, to Panama in deep water.

CRYPTOGEMMA CYMOTHOË Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 31, pl. 9, fig. 3.
Santa Barbara Islands to San Diego, California, in deep water.

CRYPTOGEMMA POLYCASTE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 30, pl. 9, figs. 4, 7.
Off Tillamook, Oregon, in 786 fathoms, to Gulf of California.

CRYPTOGEMMA CHRYSOTHEMIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 31, pl. 11, fig. 2.
Between Santa Catalina and San Clemente Islands, in 704 fathoms, and off North Coronado Island, in 656 fathoms.

CRYPTOGEMMA ADRASTIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 33, pl. 19, fig. 2.
Monterey to San Diego, California, in deep water.

CRYPTOGEMMA EIDOLA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 301.
Off San Diego, California, in 312 to 822 fathoms.

CRYPTOGEMMA (young).
Off Santa Barbara, California, in 638 fathoms.

CRYPTOGEMMA OREGONENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 301.
Off Tillamook Bay, Oregon, in 786 fathoms.

Genus ANTIPLANES Dall, 1902.

ANTIPLANES PERVERSA Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 183; Pal. Cal., vol. 2, p. 6, pl. 1, fig. 10, 1866.
Forrester Island, Alaska, to San Diego and Cortez Bank.

ANTIPLANES VINOSA Dall, 1874.
Proc. Cal. Acad. Sci., vol. 5, p. 253; Proc. U. S. Nat. Mus., vol. 24, pl. 34, fig. 1, 1902.
Bering Sea to San Diego, California.

ANTIPLANES KAMCHATICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 33, pl. 10, fig. 1.
Southwestern Bering Sea in 48 to 100 fathoms.

ANTIPLANES CATALINAE Raymond, 1904.
Nautilus, vol. 18, p. 2.
Esteros Bay to San Diego, California.

ANTIPLANES ROTULA Dall, 1919.
Arnold, Pal. San Pedro, 1903, p. 216, pl. 6, fig. 13.
Forrester Island, Alaska, to San Diego, California. Fossil at San Pedro.

ANTIPLANES SANTAROSANA Dall, 1902. (Plate 1, fig. 8.)
Proc. U. S. Nat. Mus., vol. 24, p. 515; vol. 56, pl. 11, fig. 3.
Off Santa Rosa Island. Point Sur. to San Diego, California.

ANTIPLANES DIAULAX Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 247.
Off Coronado Islands.

ANTIPLANES HYPERIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 35, pl. 9, fig. 6.
Off Drake's Bay and the Coronado Islands.

ANTIPLANES ABARBAREA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 35, pl. 9, fig. 5.
Cape Martin to Cortez Bank, California.

ANTIPLANES BRISEIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 35, pl. 22, fig. 1.
Drake's Bay to Coronado Islands.

ANTIPLANES THALAEA Dall, 1902. (Plate 1, fig. 9.)
Proc. U. S. Nat. Mus., vol. 24, p. 514; vol. 56, pl. 11, fig. 6.
Unimak Pass, Aleutian Islands, to San Diego, California.

ANTIPLANES BULIMOIDES Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 34, pl. 11, fig. 7.
Bowers Bank, Bering Sea.

ANTIPLANES BERINGI Aurivillius, 1885.
Vega Exp. Zool. Arb., vol. 4, p. 354, pl. 13, fig. 3.
Bering Sea south of St. Lawrence Island to the Aleutians and eastward to the Shumagin Islands.

ANTIPLANES LITUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 34, pl. 11, fig. 1.
Coast of Washington to Esteros Bay, California.

ANTIPLANES AMPHITRITE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 37, pl. 9, fig. 1.
Off Santa Barbara Island, California, in 638 fathoms.

ANTIPLANES AMPHITRITE BEROË Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 37.
Off San Diego, California, in 822 fathoms.

ANTIPLANES ANTIGONE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 32, pl. 11, fig. 4.
Off San Diego, California, in 822 fathoms.

ANTIPLANES AGAMEDEA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 33, pl. 24, fig. 2.
Off Cape San Quentin in 359 fathoms.

ANTIPLANES AMYCUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 36, pl. 11, fig. 5.
Monterey Bay, in 581 fathoms.

Genus BORSONELLA Dall, 1908.

BORSONELLA OMPHALE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 38, pl. 12, fig. 4.
Off Point Loma, California, in deep water.

BORSONELLA DALLI Arnold, 1903.
Pal. San Pedro, p. 201, pl. 6, fig. 2.
Drake's Bay, California, to Coronado Islands, also Pleistocene of San Pedro.

BORSONELLA CORONADOI Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 277, pl. 14, fig. 2.
San Clemente Island, California, to the Coronado Islands.

BORSONELLA DIEGENSIS Dall, 1908.
Bull Mus. Comp. Zool., vol. 43, p. 275, pl. 13, fig. 11.
Off San Diego, Panama, Ecuador, and the Galapagos Islands, in deep water.

BORSONELLA BARBARENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 37, pl. 12, fig. 6.
Off Santa Barbara Islands, in 414 fathoms.

BORSONELLA RHODOPE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 39, pl. 12, fig. 3.
Off Santa Rosa Island in 82 fathoms and San Diego in 633 fathoms.

BORSONELLA BARTSCHI Arnold, 1903.
Pal. San Pedro, p. 200, pl. 5, fig. 7, pl. 9, fig. 1.
San Pedro to San Diego, California, also Pleistocene.

BORSONELLA NICOLI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 39, pl. 12, fig. 1.
Off Point Loma, California, in deep water.

BORSONELLA CIVITELLA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 302.
Off Point Loma, California, in deep water.

BORSONELLA NYCHIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 38, pl. 12, fig. 2.
Off Point Loma, California, in 101 fathoms.

Genus LORA Gistel, 1848.

LORA SCALARIS Moller, 1842.
Index Moll. Grönl., p. 12.—G. O. SARS. Norv., pl. 23, fig. 5, 1878.
Bering Sea to Sitka, Alaska. Circumboreal.

LORA IMPRESSA Mörch, 1869.
Mem. Soc. Mal. Belg., vol. 4, p. 21.—LECHE, Novaia Zeml. Exp., Moll., pl. 1, fig. 16.
Sea Horse Islands, Arctic Ocean to Kodiak Island, Alaska. Circumboreal.

LORA INEQUITA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 44, pl. 16, fig. 9.
Plover Bay, Bering Strait, to Boca de Quadra, Alaska.

LORA KYSKANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 47, pl. 14, fig. 3.
Kyska Island, Aleutians, to Puget Sound.

LORA QUADRA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 46, pl. 15, fig. 2.
Unalaska, Aleutian Islands, to Puget Sound.

LORA ALTHORPENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 49, pl. 16, fig. 11.
Granite Cove, Port Althorp, Alaska.

LORA PRIBILOVA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 44, pl. 16, fig. 8.
Cape Lisburne, Arctic Ocean, to Esteros Bay, California.

LORA PITYSA Dall, 1919.
Proc. U. S. Nat Mus., vol. 56, p. 40. pl. 16, fig. 7.
Off Point Pinos to San Diego, California.

LORA BABYLONIA Dall, 1919.
Proc. Biol. Soc., Wash., vol. 32, p. 250.
Off Tillamook, Oregon.

LORA MAUBELLEI Dall and Bartsch, 1910.
Canada Geol. Surv. Mem. No. 1143, p. 10, pl. 1, fig. 5.
Barkley Sound, Vancouver Island.

LORA GRIPPII Dall, 1908. (Plate 3, fig. 8.)
Nautilus, vol. 21, p. 137.
Catalina Island, California, to Todos Santos Bay, Lower California.

LORA PLEUROTOMARIA Couthouy, 1838.
Boston Journ. Nat. Hist., vol. 2, p. 107, pl. 1, fig. 9.
Nunivak Island, Bering Sea, to Puget Sound. Also Atlantic.

LORA EXARATA Møller, 1842.
Index Moll. Grönl., p. 12.—G. O. SARS, Moll. Reg. Arct. Norv., pl. 16, fig. 18, 1878.
Arctic Ocean to Monterey, California (581 fathoms). Circumboreal.

LORA TABULATA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 29; Proc. U. S. Nat. Mus., vol. 56, pl. 14, fig. 1, 1919.
Sitka, Alaska, to Monterey, California.

LORA REGULUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 48, pl. 15, fig. 1.
Off Point Reyes, California, in 61 fathoms.

LORA MIONA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 47, pl. 14, fig. 2.
Boca de Quadra, Alaska, to Point Reyes, California.

LORA FIDICULA Gould, 1849.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 141; Rep. U. S. Expl. Exp. Moll., fig. 284, 1852.
Aleutian Islands to Bellingham Bay.

LORA TENUICOSTATA M. Sars, 1868.
Norske Vid. Selsk. Forh., p. 259.—G. O. SARS, Moll. Reg. Arct. Norv., pl. 17, fig. 1, 1878.
St. Lawrence and Nunivak Islands, Bering Sea, to Safety Cove, Alaska. Also Atlantic.

LORA FIORA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 302.
Adakh Island, Aleutians, to Sitka, Alaska.

LORA LOTTA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 47, pl. 14, fig. 4.
Queen Charlotte Islands, British Columbia, to San Diego, California.

LORA SIXTA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 49, pl. 16, fig. 12.
Off San Diego, California, in 359 to 822 fathoms.

LORA COLPOICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 50, pl. 16, fig. 2.
Tillamook Bay, Oregon.

LORA TENUISSIMA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 49, pl. 15, fig. 5.
Chernoffski Harbor, Unalaska, in 109 fathoms.

LORA CASENTINA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 302.
Off Point Pinos, California, in 871 fathoms.

LORA GALGANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 303.
Unalaska, Aleutian Islands, in 351 fathoms.

LORA HARPA Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 523; vol. 9, pl. 4, fig. 2, 1886.
Arctic Ocean to Queen Charlotte Islands. Circumboreal.

LORA ALBRECHTI Krause, 1885.
Arch. f. Naturg, vol. 51, p. 276, pl. 18, figs. 3, 11.
Plover Bay, Bering Strait, to Port Etches, Alaska.

LORA KRAUSEI Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 301, pl. 4, fig. 4.
Port Etches, Alaska.

LORA LÜTKENI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 48, pl. 16, fig. 5.
Port Etches, Alaska.

LORA LUTKEANA Krause, 1886.
Arch f. Naturg. vol. 56, p. 281, pl. 18, figs. 6, 16.
St. Lawrence Bay, Bering Strait.

LORA INCISULA Verrill, 1882.
Cat. Mar. Moll. N. Engl., p. 461, pl. 43, fig. 12; pl. 57, fig. 14.
St. Lawrence Bay, Bering Strait (Krause). Also Atlantic.

LORA NOBILIS Moller, 1842.
Index Moll. Grönl., p. 12.—G. O. SARS, Moll. Reg. Arct. Norv., pl. 16, figs. 19, 20, 1878.
Arctic Ocean to Bering Sea, off Akutan Pass, in 60 fathoms. Circumboreal (Krause).

LORA METSCHIGMENSIS Krause, 1886.
Arch. f. Naturg., vol. 51, p. 276, pl. 18, figs. 2, 10.
Metchigme Bay, Bering Strait.

LORA BICARINATA Couthouy, 1833.
Boston Journ. Nat. Hist., vol. 2, p. 104, pl. 1, fig. 11.
Bering Sea near St. Lawrence Island, 55 fathoms (Aurivillius). Circumboreal.

LORA BICARINATA EXSERTA Aurivillius, 1885.
Vega Exp. Vet. Arb., vol. 4, p. 376.
Arctic Ocean, north of Bering Strait.

LORA MÖRCHI Leche, 1878.
K. Svensk. Vet. Akad. Handl., vol. 16, p. 57, pl. 1, fig. 18.
Novaia Zemlia, Arctic Ocean, to Bering Strait.

LORA ELEGANS Moller, 1842.
Index Moll. Grönl., p. 13.
Blizhni Islands to St. Lawrence Island, Bering Sea (Aurivillius). Circumboreal.

LORA NOVAIASEMLIENSIS Leche, 1878.
K. Svensk. Vet. Akad. Handl., vol. 16, p. 53, pl. 1, fig. 15.
Kara Sea, Arctic Ocean to north of Bering Strait.

LORA WOODIANA Moller, 1842.
Index Moll. Grönl., p. 13.
White Island, Arctic Ocean to St. Lawrence Island, Bering Strait. Circumboreal (Aurivillius).

LORA HARPULARIA Couthouy, 1838.
Boston Journ. Nat. Hist., vol. 2, p. 106, pl. 1, fig. 10.
Point Belcher, Arctic Ocean, to Puget Sound. Circumboreal.

LORA NAZANENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 45, pl. 15, fig. 3.
Norton Sound, Alaska, to the Aleutian Islands.

LORA SURANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 45, pl. 14, fig. 6.
Off Point Sur and Point Pinos, California.

LORA MONTEREALIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 46, pl. 15, fig. 9.
Monterey Bay, 581 fathoms.

LORA DIEGENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 46, pl. 16, fig. 10.
Off La Jolla, California, to Cape San Quentin, Lower California.

LORA AMIATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 303.
Off Belkoffski, Alaska, in 15 to 75 fathoms.

LORA SANCTA-MONICAE Arnold, 1903.
Pal. San. Pedro, p. 210, pl. 8, fig. 141.
Santa Monica, California. Pleistocene.

LORA TURRICULA Montagu, 1803.
Test. Brit., p. 262, pl. 3, fig. 17.
Icy Cape, Arctic Ocean, to Puget Sound. Circumboreal.

LORA PAVLOVA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 43, pl. 14, fig. 9.
Off the Pribilof Islands in 987 fathoms.

LORA ALITAKENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 43, pl. 15, fig. 7.
Unimak Island to Alitak Bay, Kodiak, Alaska.

LORA SOLIDA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 301, pl. 3, fig. 4.
Bering Strait to Puget Sound.

LORA RASSINA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 303.
Off Bristol Bay, Bering Sea.

LORA POPOVIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 42, pl. 14, fig. 8.
Bristol Bay, Bering Sea, and south to Point Pinos, California, in progressively deeper water.

LORA RUGULATA SPITSBERGENSIS Friele, 1886.
N. Atlantic Exp., vol. 2, p. 3, pl. 7, figs. 3, 4.
Plover Bay to Port Althorp, Alaska. Circumboreal.

LORA TENUILIRATA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 98; Proc. U. S. Nat. Mus., vol. 56, pl. 15, fig. 4.
Point Barrow, Arctic Ocean, to the Shumagin Islands, Alaska.

LORA TENUILIRATA CYMATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 42, pl. 16, fig. 4.
Nunivak Island, Bering Sea, to the Shumagins.

LORA HEALYI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 42, pl. 16, fig. 8.
Arctic Ocean north of Bering Strait (Capt. Healy).

LORA MURDOCHIANA Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 524, pl. 2, fig. 8.
Point Barrow, Arctic Ocean, to the Pribilof Islands, Bering Sea.

LORA CHIACHIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 43, pl. 14, fig. 7.
Arctic Ocean to the Chiachi Islands and Port Althorp, Alaska.

LORA MITRATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 43, pl. 16, fig. 1.
Bering Strait to the Shumagin Islands, Alaska.

LORA ROSEA M. Sars, 1846.
Loven, Ind. Moll. Scand., p. 12.—G. O. SARS Moll. Reg. Arct. Norv., pl. 23, fig. 10.
Simeonoff Island, Shumagins, to San Juan Islands, Washington. Circumboreal.

LORA SIMPLEX Middendorff, 1849.
Mal. Ross., vol. 2, p. 119; Sib. Reise, pl. 12, figs. 15, 16, 1850.
Point Barrow, Arctic Ocean, to the Pribilof Islands and the Okhotsk Sea.

LORA ARCTICA A. Adams, 1855.
Proc. Zool. Soc., p. 121.
Shumagin Islands to Chirikoff Island, Alaska.

LORA LAEVIGATA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 98, pl. 16, fig. 7.
Kotzebue and Norton Sounds and south to Chirikoff Island, Alaska.

LORA VIOLACEA Mighels and Adams, 1842.
Proc. Boston Soc., Nat. Hist., vol. 1, p. 50.—G. O. Sars, Moll. Reg. Arct. Norv., pl. 17, figs. 2, 3, 1878.
Sea Horse Islands, Arctic Ocean, to Bering Strait and Sitka, Alaska. Fossil on Gravina Island. Circumboreal.

LORA NODULOSA Krause, 1886.
Arch. f. Naturg., vol. 51, p. 277, pl. 18, figs. 4, 12.
St. Lawrence Bay, Bering Strait, to the Aleutians and Cook's Inlet.

LORA ALASKENSIS Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 98; Proc. U. S. Nat. Mus., vol. 9, pl. 4, fig. 3, 1886.
Bering Strait to Puget Sound.

LORA BECKII Moller, 1842.
Index Moll. Grönl., p. 14.
Bernard Harbor, Arctic coast, and eastward.

LORA TREVELLIANA Turton, 1834.
Ann. Mag. Nat. Hist., vol. 7, p. 351.—G. O. Sars, Moll. Reg. Arct. Norv., pl. 16, fig. 13, 1878.
Arctic Ocean southward to Behm Canal, Alaska. Circumboreal.

LORA LAWRENCIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 43, pl. 15, fig. 6.
Point Belcher, Arctic Ocean, to Pribilof Islands, Bering Sea.

LORA EXCURVATA Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 63; Proc. U. S. Nat. Mus., vol. 56, pl. 14, fig. 5, 1919.
Bristol Bay, Bering Sea, to Puget Sound.

Subfamily MANGILIINAE.

Genus PLEUROTOMELLA Verrill, 1873.

Subgenus PLEUROTOMELLA s. s.

PLEUROTOMELLA THALASSICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56. p. 51, pl. 3, fig. 4.
Off Tillamook Bay, Oregon, in 786 fathoms.

PLEUROTOMELLA HERMINEA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, pl. 3, fig. 6.
Off Catalina Island, California, in 334 to 600 fathoms.

Genus GLYPHOSTOMA Gabb, 1873.

GLYPHOSTOMA CONRADIANA Gabb, 1869.
Pal. Cal., vol. 2, p. 7, pl. 1, fig. 12.
San Pedro. Also Pleistocene.

GLYPHOSTOMA ADRIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 52, pl. 17, fig. 5.
San Pedro, California, to Santa Maria Bay, Lower California.

GLYPHOSTOMA CYMODOCE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 54, pl. 17, fig. 6.
Monterey to Santa Barbara, California.

Genus PHILBERTIA Monterosato, 1884.

PHILBERTIA CANFIELDI Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 101, pl. 15, fig. 9.
Crescent City to Laguna Beach, California.

PHILBERTIA AFFINIS Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 102; Proc. Cal. Acad. Sci., vol. 5, pl. 2, fig. 7, 1873.
San Miguel Island, Long Beach, and Laguna Beach, California. Cape San Lucas?

PHILBERTIA RAVA Hinds, 1843.
Proc. Zool. Soc., p 39; Voy. *Sulphur*, Zool., pl. 5, fig. 18, 1844.
Laguna Beach, California, to Gulf of California.

PHILBERTIA CRYSTALLINA Gabb, 1865. (Plate 6, fig. 4.)
Proc. Cal. Acad. Sci., vol. 3, p. 184.
Off Catalina Island, in 50 fathoms.

PHILBERTIA HESIONE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 54.
Point Pinos to Point Loma, California.

? PHILBERTIA CASTIANIRA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 15, pl. 2, fig. 1.
Off Cape San Martin, California.

? PHILBERTIA LOUISA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 75, pl. 24, fig. 3.
Off San Luis Obispo, California.

PHILBERTIA CAPANIOLA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 304.
Off San Diego, California.

Genus MANGILIA Risso, 1826.

MANGILIA ANGULATA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 394.—ARNOLD, Pal. San Pedro, pl. 7, fig. 9, 1903.
Puget Sound to the Gulf of California.

MANGILIA ALEUTICA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 99; Proc. U. S. Nat. Mus., vol. 9, pl. 3, fig. 6, 1886.
Cape Sabine, Arctic Ocean, to Fuca Strait.

MANGILIA CETOLACA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 286; Pal. San Pedro, pl. 6, fig. 7, 1903.
Lower California to Salina Cruz, Mexico. Pleistocene of San Pedro and Santa Monica, California.

MANGILIA CARLOTTAE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 65, pl. 21, figs. 9, 12.
Off Queen Charlotte Islands, British Columbia, in 876 fathoms.

MANGILIA NUNIVAKENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 65, pl. 1, fig. 2.
Nunivak Island, Bering Sea.

MANGILIA ERIOPIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 67, pl. 23, fig. 1.
Forrester Island, Alaska, and the Queen Charlotte Islands.

MANGILIA OLDROYDI Arnold, 1903.
Pal. San Pedro, p. 213, pl. 6, fig. 16.
Pleistocene, San Pedro, California.

MANGILIA CONSTRICTA Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 84.
Catalina Island, 80 fathoms.

MANGILIA GRANITICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 67.
Granite Cove, Port Althorp, Alaska.

MANGILIA ALTHORPI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 68, pl. 19, fig. 9.
Granite Cove, Port Althorp, Alaska.

MANGILIA SCULPTURATA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, 290, pl. 4, fig. 7.
Chiachi Islands to Port Etches, Alaska.

MANGILIA HOOVERI Arnold, 1903.
Pal. San Pedro, p. 212, pl. 9, fig. 5.
San Pedro to San Diego, California. Pleistocene.

MANGILIA BETA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 64, pl. 22, fig. 4.
Point Ano Nuevo to San Diego, California.

MANGILIA ERIPHYLE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 69.
Off Esteros Bay, California, to Coronado Islands.

MANGILIA CESTA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 71, pl. 21, fig. 7.
"California" (Mrs. Blood).

MANGILIA EVADNE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 69, pl. 23, fig. 2.
Off Santa Rosa Island, California, in 53 fathoms.

MANGILIA PULCHRIOR Dall, 1919.
Cpr. 1863, Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 394 (preoccupied).
Monterey, California, to Magdalena Bay, Lower California.

MANGILIA OENOA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 66, pl. 8, fig. 6.
San Pedro to San Diego, California.

MANGILIA PAINEI Arnold, 1903.
Pal. San Pedro, p. 214, pl. 8, fig. 1.
San Pedro to San Diego, California. Pleistocene.

MANGILIA PHILODICE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 66, pl. 22, fig. 7.
Point Ano Nuevo, California, to Coronado Islands.

MANGILIA PERATTENUATA Dall, 1905.
Nautilus, vol. 18, p. 123; Proc. U. S. Nat. Mus., vol. 56, pl. 20, fig. 11, 1919.
Monterey Bay, California.

MANGILIA ALESIDOTA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 304.
Catalina Island, California.

Section KURTZIELLA Dall, 1918.

MANGILIA ARTEAGA Dall and Bartsch, 1910.
Canada Geol. Survey Mem., No. 1143, p. 11, pl. 11, fig. 4.
Vancouver Island to San Diego, California.

MANGILIA ARTEAGA ROPERI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 64, pl. 22, fig. 5.
Monterey to Cape San Lucas.

MANGILIA NEWCOMBEI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 71, pl. 21, fig. 4.
Vancouver Island to Drake's Bay, California.

MANGILIA HECETAE Dall and Bartsch, 1910.
Canada Geol. Survey, Mem. No. 1143, p. 10, pl. 1, fig. 6.
Vancouver Island to San Diego, California.

MANGILIA HEBE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 63, pl. 20, fig. 10.
San Diego, California.

MANGILIA TERSA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 305.
San Diego, California.

Section CLATHROMANGILIA Monterosato, 1884.

MANGILIA INTERLIRATA Stearns, 1871.
Proc. Cal. Acad. Sci., vol. 4, p. 226, pl. 1, fig. 10.
Monterey to Catalina Island, California.

MANGILIA RHYSSA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 62, pl. 21, fig. 3.
Near San Diego, California.

MANGILIA INTERFOSSA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 30.
Vancouver Island, British Columbia, to Catalina Island, California.

MANGILIA INTERFOSSA PEDROANA Arnold, 1903.
Pal. San Pedro, p. 213, pl. 6, fig. 2.
San Pedro, California. Pleistocene.

MANGILIA LINEOLATA Reeve, 1846.
Conch. Icon., *Pleurotoma*, fig. 337.
Catalina Island, California (Brannan), to Panama and the Galapagos Islands.

MANGILIA CREBRICOSTATA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 30.
Forrester Island, Alaska, to Monterey, California.

MANGILIA LEVIDENSIS Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 63; Proc. U. S. Nat. Mus., vol. 56, pl. 21, fig. 1, 1919.
Bering Strait to Monterey, California.

Genus CYTHARELLA Monterosato, 1875.

Section CYTHARELLA s. s.

CYTHARELLA HEXAGONA Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 185.
Monterey to San Diego, California.

CYTHARELLA BRANNERI Arnold, 1903.
Pal. San Pedro, p. 211, pl. 9, fig. 10.
San Pedro to San Diego, Pleistocene. Panama, Recent.

CYTHARELLA ACULEA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 74.
San Diego, California, to Cape San Lucas.

CYTHARELLA HIPPOLITA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 76, pl. 22, figs. 6, 8.
San Diego to Lower California.

CYTHARELLA VICTORIANA Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 13, pl. 1, fig. 9.
Victoria, Vancouver Island.

CYTHARELLA AMATULA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 78, pl. 21, fig. 2.
San Diego, California.

CYTHARELLA MERITA Hinds, 1843.
Proc. Zool. Soc., p. 42; Voy. *Sulphur*, Moll., pl. 6, fig. 20, 1844.
Monterey, California, to Gulf of Nicoya, Central America.

Subgenus AGATHOTOMA Cossmann, 1889.

AGATHOTOMA DENSILINEATA Dall, 1920.
Mangilia striosa in Pal. San Pedro; not of C. B. Adams.
San Pedro, California, to Gulf of California.

AGATHOTOMA FUSCONOTATA Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 46.
Laguna Beach, California, to Gulf of California.

AGATHOTOMA JANIRA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 75, pl. 21, fig. 10.
San Diego, California, to Scammon Lagoon, Lower California.

AGATHOTOMA POMARA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 305.
San Pedro, California (Lowe).

Genus DAPHNELLA Hinds, 1844.

DAPHNELLA CLATHRATA Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 185.
San Miguel Island to San Diego and Cortez Bank, California.

? DAPHNELLA FUSCOLIGATA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 100.—TRYON, Man., vol. 6, pl. 34, fig. 95.
Monterey to San Diego, California.

Genus TARANIS Jeffreys, 1870.

TARANIS STRONGI Arnold, 1903.
Pal. San Pedro, p. 215, pl. 9, fig. 7.
Forrester Island, Alaska, to San Diego, California. Pleistocene, San Pedro, California.

Family CANCELLARIIDAE.

Genus CANCELLARIA Lamarck, 1799.

Subgenus PROGABBIA Dall, 1918.

PROGABBIA COOPERI Gabb, 1865. (Plate 5, figs. 3, 4.)
Proc. Cal. Acad. Sci., vol. 3, p. 186.—TRYON, Man, vol. 7, pl. 4, fig. 66, 1885.
Monterey, California, to the Coronado Islands.

PROGABBIA IO Dall, 1896.
Proc. U. S. Nat. Mus., vol. 18, p. 14; Bull. Mus. Comp. Zool., vol. 43, No. 6. pl. 1, fig. 2
San Diego, California (650 fathoms) to Gulf of Panama (322 fathoms).

PROGABBIA CORBICULA Dall, 1906.
Bull. Mus. Comp. Zool. vol. 43, No. 6, p. 294, pl. 1, fig. 4.
Santa Barbara Islands to Coronado Islands.

Section CRAWFORDINA Dall, 1919.

PROGABBIA CRAWFORDIANA Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 182, pl. 6, fig. 1.
Bodega Bay, to San Diego, California.

Subgenus SVELTIA Jousseaume, 1888.

SVELTIA MODESTA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 32.
Aleutian Islands, Alaska, to Neah Bay and Puget Sound.

SVELTIA UNALASHKENSIS Dall, 1873.
Proc. Cal. Acad. Sci., vol. 5, p. 58, pl. 2, fig. 1.
Unalaska, Alaska, to Cape Blanco, Oregon.

SVELTIA CIRCUMCINCTA Dall, 1873.
Proc. Cal. Acad. Sci., vol. 5, p. 59, pl. 2, fig. 2.
Unalaska, to Port Etches, Alaska.

Genus ADMETE Kroyer, 1842.

ADMETE MIDDENDORFFIANA Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 524; vol. 24, pl. 38, fig. 6, 1902.
Arctic coast of Alaska to Bristol Bay, Bering Sea.

ADMETE REGINA Dall, 1911.
Nautilus, vol. 25, No. 2, p. 19.
Arctic Sea to Pribilof Island.

ADMETE RHYSSA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 306.
Santa Rosa Island, California, to South Coronado Island. Also Pleistocene.

ADMETE MICROSOMA Dall, 1908.
Bull. Mus., Comp. Zool., vol. 43, p. 296, pl. 11, fig. 10.
North Coronado Island (656 fathoms) to Acapulco, Mexico (660 fathoms).

ADMETE COUTHOUYI Jay, 1839. (Plate 16, fig. 7.)
Cat. Coll., p. 77; Boston Journ. Nat. Hist., vol. 2, pl. 3, fig. 3.
Arctic Sea to San Diego, California. Circumboreal.

ADMETE COUTHOUYI LAEVIOR Leche, 1878.
K. Svensk. Vet. Akad, Handl., vol. 16, p. 48.
Arctic Ocean to Sea Lion Rock, Washington.

ADMETE COUTHOUYI GRACILIOR Carpenter, 1866.
Gabb, Pal. Cal., vol. 2, p. 50.
With the type. Also Pleistocene, San Pedro, California.

ADMETE CALIFORNICA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 296, pl. 4, fig. 4.
Tillamook, Oregon, to Gulf of California, in deep water.

ADMETE WOODWORTHI Dall, 1905.
Nautilus, vol. 18, No. 11, p. 123.
Monterey to the Santa Barbara Islands.

Superfamily RHACHIGLOSSA.

(FISSIPEDIA.)

Family OLIVIDAE.

Genus OLIVELLA Swainson, 1840.

OLIVELLA BIPLICATA Sowerby, 1825.
Tankerville Cat., App., p. 33.—TRYON, Man., vol. 5, pl. 34, fig. 58.
Vancouver Island to Magdalena Bay, Lower California.

OLIVELLA BIPLICATA LAPILLUS Vanatta, 1915.
Nautilus, vol. 29, p. 71.—SOWERBY, Thes., vol. 4, pl. 18, fig. 290.
San Pedro, California.

OLIVELLA BOETICA Carpenter, 1864. **(Plate 15, fig. 1.)**
Suppl. Rep. Brit. Assoc., p. 651.
Kodiak Island, Alaska, to Cape San Lucas.

OLIVELLA PEDROANA Conrad, 1855.
Pacific R. R. Repts., vol. 5, pl. 6, fig. 51.—TRYON, Man., vol. 5, pl. 14, fig. 62.
Puget Sound to Cape San Lucas.

OLIVELLA PORTERI Dall, 1910.
Nautilus, vol. 23. No. 12, p. 133.
Redondo, California, to Magdalena Bay, Lower California.

(SOLIDIPEDIA.)

Family MARGINELLIDAE.

Genus MARGINELLA Lamarck, 1799.

MARGINELLA JEWETTII Carpenter, 1857.
Proc. Zool. Soc., p. 207.—TRYON, Man., vol. 5, pl. 12, fig. 57.
Monterey to Lower California.

MARGINELLA SUBTRIGONA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 397.—TRYON, Man., vol. 5, pl. 12, fig. 55.
Monterey to San Diego, California.

MARGINELLA REGULARIS Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 398.—TRYON, Man., vol. 5, pl. 12, fig. 56.
Monterey to Gulf of California.

Subgenus HYALINA Schumacher, 1817.

HYALINA CALIFORNICA Tomlin, 1916.
Nautilus, vol. 29, p. 138.—ARNOLD, Pal. San Pedro, pl. 4, fig. 9.
San Pedro, California, to Puerto Libertad, Mexico.

HYALINA MYRMECOÖN Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 308.
San Diego, California.

Genus CYSTISCUS Stimpson, 1865.

CYSTISCUS POLITULUS (Cooper MS.) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 307.
Santa Barbara, California, to Cape San Lucas.

CYSTISCUS MINOR C. B. Adams, 1852.
Panama Shells, p. 264.—TRYON, Man., vol. 5, pl. 12, fig. 65.
San Pedro, California, to Panama.

Genus MEROVIA Dall, 1920.

MEROVIA PYRIFORMIS Carpenter, 1865.
Journ. de Conchyl., vol. 13, p. 148.—TRYON, Man., vol. 5, pl. 13, fig. 38.
Peril Strait, Alaska, to Mazatlan, Mexico.

Family VOLUTIDAE.

Genus FULGORARIA Schumacher, 1817.

Subgenus BOREOMELON Dall, 1918.

BOREOMELON STEARNSII Dall, 1872 .
Proc. Cal. Acad. Sci., vol. 4, p. 270, pl. 1, fig. 1.
Pribilof, Aleutian, and Shumagin Islands, Alaska.

Genus PHENACOPTYGMA Dall, 1918.

PHENACOPTYGMA CORTEZI Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 292.
Cortez Bank and off San Diego, California, in deep water.

Family MITRIDAE.

Genus STRIGATELLA Swainson, 1840.

Subgenus ATRIMITRA Dall, 1918.

ATRIMITRA IDAE Melvill, 1893.
The Conchologist, vol. 2, p. 140, pl. 1, fig. 6.
Farallones Islands to Cortez Bank, California.

ATRIMITRA IDAE MONTEREYENSIS Berry, 1920.
Proc. Mal. Soc. London, vol. 14, p. 31, figs. 1–4.
Monterey to San Diego, California.

ATRIMITRA CATALINAE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 308.
Crescent City to San Diego, California.

ATRIMITRA DIEGENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 300.
Catalina Island to San Diego, California.

ATRIMITRA? LOWEI Dall, 1903. (Plate 15, fig. 4.)
Proc. Biol. Soc. Wash., vol. 16, p. 173.
Off Avalon, Catalina Island, California.

Genus MITRA Lamarck, 1799.

Section THALA H. and A. Adams, 1853.

MITRA SOLITARIA C. B. Adams, 1852.
Panama Shells, p. 44; Proc. U. S. Nat. Mus., vol. 13, pl. 15, fig. 14, 1890.
Point Loma, California, to Panama.

MITRA ORCUTTI Dall, 1920.
Nautilus, vol. 23, No. 3, p. 103.
La Jolla, California.

Genus VOLUTOMITRA Gray, 1857.

VOLUTOMITRA ALASKANA Dall, 1902. (Plate 11, fig. 3.)
Nautilus, vol. 15, p. 103; Smithsonian Misc. Coll., vol. 48, p. 142. 1907.
Pribilof Islands and southward. Off San Diego, California, in 822 fathoms.

? Genus MITROMORPHA A. Adams, 1865.

MITROMORPHA FILOSA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 182; Proc. U. S. Nat. Mus., vol. 15, pl. 19, fig. 1, 1892.
Monterey, California, to Gulf of California.

MITROMORPHA ASPERA Carpenter, 1865.
Journ. de Conchyl., vol. 12, p. 146.—Tryon, Man., vol. 6, pl. 25, fig. 61.
Monterey to San Pedro, California.

MITROMORPHA GRACILIOR Hemphill, 1884.
Tryon, Man. Conch. vol. 6, p. 317. pl. 25, fig. 62.
Forrester Island, Alaska, to San Diego, California.

MITROMORPHA GRACILIOR INTERMEDIA Arnold, 1903.
Pal. San Pedro, p. 223, pl. 4, fig. 10.
Santa Rosa Island. Also Pliocene of San Pedro and Pleistocene of Santa Barbara, California.

Family FASCIOLARIIDAE.

Genus PTYCHATRACTUS Stimpson, 1871.

PTYCHATRACTUS OCCIDENTALIS Stearns, 1871. (Plate 6, fig. 8.)
Conch. Memoranda, No. 7, p. 1; Proc. Cal. Acad. Sci., vol. 5, p. 79, 1873.
Bering Island, Bering Sea, and eastward to the Shumagin Islands, Alaska.

PTYCHATRACTUS CALIFORNICUS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 299.
Monterey Bay, and near San Diego, California, in 822 fathoms.

Genus FUSINUS Rafinesque, 1815.

Section HEILPRINIA Grabau, 1904.

FUSINUS TRASKI Dall, 1915.
Nautilus. vol. 29, No. 5, p. 54.—Arnold, Pal. San Pedro, pl. 4, fig. 7, 1903.
San Pedro to San Diego, California.

FUSINUS BARBARENSIS Trask, 1855.
Proc. Cal. Acad. Sci., vol. 1, p. 42.—Arnold, Pal. San Pedro, pl. 4, fig. 15.
Heceta Bank, Oregon, to San Diego, California.

FUSINUS MONKSAE Dall, 1915.
Nautilus, vol. 29, No. 5, p. 55.
Banks Island, British Columbia, to Pequena Bay, Lower California.

FUSINUS KOBELTI Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 54; Proc. U. S. Nat. Mus., vol. 14, pl. 6, fig. 4, 1891.
Monterey to Catalina Island, California.

Section FUSINUS s. s.

FUSINUS LUTEOPICTUS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 3; Proc. U. S. Nat. Mus., vol. 15, pl. 20, fig. 1, 1892.
Monterey to Gulf of California.

FUSINUS DIMINUTUS Dall, 1915.
Nautilus, vol. 29, No. 5, p. 56.
San Pedro, California.

Section HARFORDIA Dall, 1920.

FUSINUS HARFORDII Stearns, 1871.
Conch. Memoranda, No. 7, p. 1; Proc. U. S. Nat. Mus., vol. 14, pl. 6, fig. 6, 1891.
Coast of Mendocino County, California.

Subgenus ROPERIA Dall, 1898.

ROPERIA ROPERI Dall, 1898.
Nautilus, vol. 12, No. 1, p. 4; Proc. U. S. Nat. Mus., vol. 24, pl. 34, fig. 8, 1902.
San Pedro, California, in deep water.

Subgenus APTYXIS Troschel, 1868.

APTYXIS TAYLORIANUS Reeve, 1848.
Conch. Icon., *Fusus*, fig. 85.
San Pedro? (Baldridge). Cape San Lucas to Panama.

Genus METZGERIA Norman, 1879.

METZGERIA CALIFORNICA Dall, 1903. (Plate 13, fig. 7.)
Nautilus, vol. 17, No. 5, p. 51.
Off Avalon, Catalina Island, California.

Family CHRYSODOMIDAE.

Genus KELLETTIA Bayle, 1884.

KELLETTIA KELLETTII Forbes, 1850.
Proc. Zool. Soc., p. 274, pl. 9, fig. 10.
Santa Barbara, California, to San Quentin Bay, Lower California. Also Japan.

Genus MACRON H. and A. Adams, 1853.

MACRON AETHIOPS KELLETTII A. Adams, 1853.
Proc. Zool. Soc., p. 185.—TRYON, Man., pl. 82, fig. 477.
Catalina Island? (Cooper). Lower California and the Gulf of California.

MACRON LIVIDUS A. Adams, 1854.
Proc. Zool. Soc., p. 136.—TRYON, Man., pl. 82, fig. 478.
Farallones Islands, California, to San Bartolomé Bay, Lower California.

Genus PYRULOFUSUS Mörch, 1869.

PYRULOFUSUS DEFORMIS Reeve, 1847.
Conch. Icon., *Fusus*, fig. 45.
Arctic Ocean and south to the Shumagin Islands, Alaska. Circumboreal.

PYRULOFUSUS HARPA Mörch, 1858. (Plate 7.)
Novit. Conch., Moll. Marina, p. 5, pl. 1, figs. 3, 4.
Pribilof Islands to the Aleutians and eastward to Kodiak Island, Alaska.

PYRULOFUSUS HARPA DEXIUS Dall, 1907.
Smithsonian Misc. Coll., vol. 50, p. 164.
Petrel Bank, Bering Sea, in 54 fathoms.

Genus VOLUTOPSIUS Mörch, 1857.

VOLUTOPSIUS FRAGILIS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 187; vol. 17, pl. 28, fig. 4, 1894.
Bering Sea, 15 to 121 fathoms.

VOLUTOPSIUS MELONIS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 187; vol. 17, pl. 28, figs. 2, 3, 1894.
Bering Sea, 227 fathoms.

VOLUTOPSIUS BERINGI Middendorff, 1848.
Mal. Rossica, vol. 2, p. 147, pl. 3, figs. 5, 6.
Arctic Ocean to Pribilof Islands, 17 to 50 fathoms.

VOLUTOPSIUS BERINGI KOBELTI Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 528, pl. 35, fig. 2.
North end of Nunivak Island, Bering Sea, and at the Pribilof Islands.

VOLUTOPSIUS STEFANSSONI Dall, 1919. (Plate 9, fig. 2.)
Sci. Res. Canadian Arct. Exp., vol. 8, p. 22*a*, pl. 1.
Arctic Ocean to Pribilof Islands, Bering Sea.

VOLUTOPSIUS ROTUNDUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 310.
Kodiak Island to Cooks Inlet.

VOLUTOPSIUS MIDDENDORFFII Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 186; vol. 17, pl. 28, fig. 1, 1894.
Bering Sea, 57 to 225 fathoms.

VOLUTOPSIUS SIMPLEX Dall, 1907. (Plate 9, fig. 1.)
Smithsonian Misc. Coll., vol. 50, p. 164.
Off Bering Island, Bering Sea, in 72 fathoms.

VOLUTOPSIUS ATTENUATUS Dall, 1874.
Proc. Cal. Acad. Sci., vol. 5, p. 253; Proc. U. S. Nat. Mus., vol. 24, pl. 36, fig. 3, 1902.
Arctic Ocean south to the Pribilof Islands and Bristol Bay.

VOLUTOPSIUS TROPHONIUS Dall, 1902. (Plate 8, fig. 11.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 527.
Bering Sea, in 81 fathoms, south of the Pribilof Islands.

VOLUTOPSIUS FILOSUS Dall, 1919. (Plate 10, fig. 1.)
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 310.
From the Pribilof to the Aleutian Islands, Bering Sea.

VOLUTOPSIUS CALLORHINUS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 7; Sci. Res. Expl. Alaska, pl. 1, fig. 3, 1879.
Pribilof Islands, Bering Sea.

VOLUTOPSIUS CALLORHINUS STEJNEGERI Dall, 1884. (Plate 8, fig. 9.)
Proc. U. S. Nat. Mus., vol. 7, p. 346, pl. 2, fig. 5.
Bering Island.

VOLUTOPSIUS CASTANEUS Mörch, 1858.
Novit. Conch., Moll. Marina, p. 7, pl. 1, figs. 1, 2.
Pribilof, Aleutian, and Kodiak Islands, Alaska. (Sitka, Dunbar.)

VOLUTOPSIUS REGULARIS Dall, 1873.
Proc. Cal. Acad. Sci., vol. 5, p. 60, pl. 2, fig. 6.
Pribilof, Aleutian, and Sannakh Islands, Alaska.

Genus BERINGIUS Dall, 1879.

BERINGIUS CREBRICOSTATUS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 6; Sci. Res. Expl. Alaska, pl. 2, fig. 1, *a–c*, 1879; Proc. U. S. Nat. Mus., vol. 24, pl. 35, fig. 1.
Plover Bay, the Aleutian Islands, and eastward to the Shumagin Islands, Alaska.

BERINGIUS CREBRICOSTATUS UNDATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 311.
Unalaska, Alaska, south and east to British Columbia in 238 fathoms.

BERINGIUS KENNICOTTII Dall, 1907.
Amer. Journ. Conch., vol. 7, p. 108; Proc. U. S. Nat. Mus., vol. 24, pl. 35, fig. 3, 1902.
Aleutian Islands to Cooks Inlet, Alaska.

BERINGIUS KENNICOTTII INCISUS Dall, 1907.
Smithsonian Misc. Coll., vol. 50, p. 163.
Petrel Bank, Bering Sea, 54 fathoms.

BERINGIUS STIMPSONI Gould, 1860.
Proc. Boston Soc. Nat. Hist., vol. 7, p. 325.
Point Barrow to the Pribilof Islands, Alaska.

BERINGIUS MALLEATUS Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 523.
Arctic Ocean and Northern Bering Sea.

BERINGIUS FRIELEI Dall, 1894.
Proc. U. S. Nat. Mus., vol. 17, p. 711, pl. 27, fig. 8.
Pribilof Islands, Bering Sea, 66 fathoms.

BERINGIUS ALEUTICUS Dall, 1894.
Proc. U. S. Nat. Mus., vol 17, p. 711, pl. 29. fig. 2.
Amukhta Pass, Aleutian Islands, 248 fathoms.

BERINGIUS MARSHALLI Dall, 1919. **(Plate 9, fig. 8.)**
Proc. U. S. Nat. Mus., vol. 56. p. 311.
Pribilof Islands to Unalaska, Alaska.

BERINGIUS INDENTATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 312.
Kotzebue Sound to the Aleutian Islands, also north Japan seas.

Genus LIOMESUS Stimpson, 1865.

LIOMESUS NASSULA Dall, 1901. **(Plate 8, fig. 6.)**
Nautilus, vol. 15, No. 8, p. 89.
Bering Sea from the Pribilof Islands to the Peninsula of Alaska, 34 to 121 fathoms. Japan?

LIOMESUS OOIDES Middendorff, 1848.
Bull. Acad. St. Petersb., vol. 7, No. 16, p. 6; Sib. Reise, vol. 2, 326, pl. 8, figs. 7, 8.
Okhotsk Sea, also Pleistocene of Yesso, Hokkaido, Japan.

LIOMESUS OOIDES CANALICULATUS Dall, 1874.
Proc. Cal. Acad. Sci., vol. 5, p. 252; Sci. Res. Expl. Alaska, pl. 4, fig. 4. Proc. U. S. Nat. Mus., vol. 24, pl. 38, fig. 2.
Icy Cape, Arctic Ocean, to the Shumagin Islands.

LIOMESUS NUX Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 7; Proc. U. S. Nat. Mus., vol. 24, pl. 38, fig. 7.
Aleutian Islands to Shumagin Islands, Alaska. Also Japan Sea.

Genus MOHNIA Friele, 1878.

MOHNIA ROBUSTA Dall, 1913. **(Plate 10, fig. 12.)**
Proc. Acad. Nat. Sci. Phila., p. 501.
Off the Pribilof Islands, 987 to 1,401 fathoms.

MOHNIA CORBIS Dall, 1913. **(Plate 12, fig. 10.)**
Proc. Acad. Nat. Sci., Phila., p. 501.
Off the Pribilof Islands, 1,771 fathoms.

MOHNIA FRIELEI Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 186; vol. 17, pl. 29, fig. 8, 1894.
Off Queen Charlotte Islands, British Columbia, in 876 fathoms.

MOHNIA VERNALIS Dall, 1913.
Proc. Acad. Nat. Sci. Phila., p. 502.
Tillamook Bay, Oregon, to Monterey, California; 786 to 881 fathoms.

MOHNIA SIPHONOIDEA Dall, 1913. (Plate 12, fig. 11.)
Proc. Acad. Nat. Sci. Phila., p. 502.
Off Pribilof Islands, in 987 fathoms.

MOHNIA EXQUISITA Dall, 1913. (Plate 10, figs. 10, 11.)
Proc. Acad. Nat. Sci. Phila., p. 502.
Bering Sea, off Koniugi Island, Aleutians, in 1,766 fathoms.

Genus ANCISTROLEPIS Dall, 1894.

ANCISTROLEPIS EUCOSMIUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 187; vol. 17, pl. 29, fig. 7, 1894.
Pribilof Islands, Alaska, to Tillamook Bay, Oregon, 67 to 786 fathoms.

ANCISTROLEPIS EUCOSMIUS BICINCTUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 313.
Pribilof Islands to Shumagin Islands, Alaska, in 34 to 280 fathoms.

ANCISTROLEPIS MAGNUS Dall, 1895.
Proc. U. S. Nat. Mus., vol. 17, p. 709, pl. 29, fig. 5.
Okhotsk and Bering Seas, 25 to 70 fathoms.

ANCISTROLEPIS CALIFORNICUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 313.
Fuca Strait to San Diego, California, 152 to 984 fathoms.

ANCISTROLEPIS BERINGIANUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 313.
Bering Sea, off Starichkoff Island, 58 fathoms.

? Genus SULCOSINUS Dall, 1894.

SULCOSINUS TAPHRIUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 186; vol. 17, p. 707, pl. 29, fig. 6, 1895.
Bering Sea, off Unalaska, in 351 fathoms.

Genus EXILIA Conrad, 1860.

EXILIA RECTIROSTRIS Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 64; Proc. U. S. Nat. Mus., vol. 24, pl. 34, fig. 2.
Behm Canal, Alaska, to Cape San Quentin, Lower California.

EXILIA KELSEYI Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 249.
Bodega Head to San Diego, California, 50 to 359 fathoms.

Genus PLICIFUSUS Dall, 1902.

PLICIFUSUS KROYERI Moller, 1842.
Ind. Moll. Grönl., p. 15.—TRYON, Man., vol. 3, pl. 53, fig. 335.
Point Barrow, Arctic Ocean. Circumboreal.

PLICIFUSUS ARCTICUS Philippi, 1850.
Abb. u. Beschr. Moll., vol. 3, p. 119, pl. 5, fig. 5.
Arctic Ocean, Bering Sea, Aleutians to Shumagin Islands, Alaska. Circumboreal.

PLICIFUSUS JOHANSENI Dall, 1919.
Sci. Res. Canadian Arct. Exp., vol. 8, p. 21 A, pl. 3.
Point Barrow to Icy Cape, Arctic Ocean.

?-PLICIFUSUS VERKRUZENI Kobelt, 1876.
Jahrb. Mal. Ges., 1876, p. 70, pl. 2, fig. 1.
Arctic Ocean to Bering Strait. Circumboreal.

Subgenus RETIFUSUS Dall, 1916.

RETIFUSUS VIRENS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 6; Sci. Res. Expl. Alaska, pl. 2, fig. 3, 1879.
Bering Sea to Middleton Island, Alaska. Japan?

RETIFUSUS INCISUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 314.
Arctic Ocean; Bering Sea; east to the Shumagin Islands, 38 to 54 fathoms.

RETIFUSUS OCEANODROMAE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 314.
Petrel Bank, Bering Sea; the Aleutians eastward to the Shumagin Islands.

Section MICROFUSUS Dall, 1916.

RETIFUSUS BRUNNEUS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 6; Sci. Res. Expl. Alaska, pl. 2, fig. 4, 1879.
Port Clarence, Bering Strait, to Nunivak and the Pribilof Islands.

Section LATIFUSUS Dall, 1916.

RETIFUSUS GRISEUS Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 322, pl. 5, fig. 6.
Bering Sea (27 fathoms) to San Diego, California (636 fathoms).

Section HELICOFUSUS Dall, 1916.

PLICIFUSUS LATICORDATUS Dall, 1907.
Smithsonian Misc. Coll., vol. 50, p. 161.
Bering Sea (33 to 76 fathoms) south to Fuca Strait (559 fathoms).

Genus COLUS Bolten, 1798.

Subgenus AULACOFUSUS Dall, 1918.

AULACOFUSUS SPITSBERGENSIS Reeve, 1855.
Last of the Arctic Voy., p. 395, pl. 32, fig. 6.
Circumboreal. Arctic Ocean south to Northern Japan and Fuca Strait, 12 to 142 fathoms.

AULACOFUSUS PERISCELIDUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 187; vol. 17, pl. 27, fig. 6, 1894.
Commander and Aleutian Islands eastward to Sannakh Islands, Alaska.

AULACOFUSUS HERENDEENI Dall, 1902. (Plate 8, fig. 4.)
Proc. U. S. Nat. Mus., vol. 24, p. 527, pl. 36, fig. 10.
Southern Bering Sea, Nunivak Island to the Aleutians and eastward to the Shumagin Islands, Alaska, 41 to 284 fathoms.

AULACOFUSUS NOBILIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 315.
Near Pribilof Islands, 60 fathoms.

AULACOFUSUS CALAMEUS Dall, 1907. (Plate 10, fig. 5.)
Smithsonian Misc. Coll., vol. 50, p. 158.
Western Bering Sea off Starichkoff Island, in 632 fathoms.

AULACOFUSUS OMBRONIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 315.
Eastern Bering Sea, from Nunivak Island south to Bristol Bay and the Pribilof Islands.

AULACOFUSUS BRISTOLENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 316.
Pribilof Islands north and east to Unimak Island, Alaska, 27 to 62 fathoms.

AULACOFUSUS, species (jun.)
Boca de Quadra, Alaska, in 160 fathoms.

AULACOFUSUS ESYCHUS Dall, 1907. (Plate 10, fig. 8.)
Smithsonian Misc. Coll., vol. 50, p. 159.
Point Barrow, Arctic Ocean, to Bering Island.

AULACOFUSUS ROSEUS Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 7; Sci. Res. Expl. Alaska, pl. 3, fig. 5, 1879.
Off Cape Lisburne, Arctic Ocean, 10 to 15 fathoms.

AULACOFUSUS BARBARINUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 316.
Southern Bering Sea, off Khudubine Island, 53 fathoms.

AULACOFUSUS SAPIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 317.
Off Sitka, Alaska, in 1,569 fathoms.

AULACOFUSUS CALATHUS Dall, 1919. (Plate 8, fig. 2.)
Proc. U. S. Nat. Mus., vol. 56, p. 317.
Near Shumagin Islands, 159 fathoms.

AULACOFUSUS CAPPONIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 317.
Bering Strait near Port Clarence.

AULACOFUSUS ACOSMIUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 188; vol. 17, pl. 27, fig. 3, 1894.
Off Pribilof Islands, Bering Sea (688 fathoms), to Unalaska (399 fathoms).

AULACOFUSUS HALIDONUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 318.
Pribilof Islands (81 fathoms) to Monterey Bay, California (633 fathoms).

Section LIMATOFUSUS Dall, 1918.

AULACOFUSUS TROPHIUS Dall, 1919. (Plate 10, fig. 9.)
Proc. U. S. Nat. Mus., vol. 56, p. 319.
Eastern Bering Sea south of Pribilof Islands (27 fathoms) south to San Nicolas Island, California (1,100 fathoms).

AULACOFUSUS TAHWITANUS Dall, 1918.
Proc. U. S. Nat. Mus., vol. 54, p. 228.
Off Tahwit Head, Washington, in 178 fathoms.

AULACOFUSUS MORDITUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 319.
Gulf of Georgia, 60 to 200 fathoms.

AULACOFUSUS TIMETUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 318.
Bering Sea, off Unalaska, in 19 fathoms.

AULACOFUSUS DIMIDIATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 319.
Off Tillamook Bay, Oregon, in 786 fathoms.

AULACOFUSUS SEVERINUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 320.
Off Pigeon Point and Monterey Bay, California, in 278 to 296 fathoms.

AULACOFUSUS PULCIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 318.
Arctic Ocean, north of Bering Strait (Healy).

AULACOFUSUS GEORGIANUS Dall, 1920. (Plate 8, fig. 3.)
Gulf of Georgia, in 60 to 200 fathoms.

AULACOFUSUS HALIMERIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 320.
British Columbia to San Diego, California, 60 to 822 fathoms.

AULACOFUSUS TROMBINUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 321.
Pribilof Islands, Bering Sea, in 36 fathoms.

Subgenus ANOMALOSIPHO Dautzenberg and Fischer, 1912.

ANOMALOSIPHO MARTENSI Krause, 1885.
Arch. f. Naturg., vol. 51, p. 287, pl. 18, fig. 18.
Plover Bay, Bering Strait, 20 fathoms.

ANOMALOSIPHO ADONIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 316.
Straits of Fuca south to San Diego, California, in 175 to 822 fathoms; Northern Japan, 25 to 508 fathoms.

ANOMALOSIPHO CONULUS Aurivillius, 1885.
Vega Exp. Vet. Arb., vol. 4, p. 354, pl. 13, fig. 6.
Arctic Ocean north of Bering Strait. Circumboreal.?

Subgenus LATISIPHO Dall, 1916.

LATISIPHO HYPOLISPUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 188; vol. 17, pl. 27, fig. 1, 1894.
Arctic Ocean (Healy) to the Aleutian Islands and eastward to Shelikoff Strait, Alaska.

LATISIPHO ERRONES Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 321.
Pribilof Islands, Bering Sea (18 fathoms), to Strait of Fuca (308 fathoms).

LATISIPHO NALLI Dall, 1873.
Proc. Cal. Acad. Sci., vol. 5, p. 59, pl. 2, fig. 3.
Nunivak Island, Bering Sea, to San Diego, California, in 65 to 293 fathoms.

LATISIPHO JORDANI Dall, 1913. **(Plate 12, fig. 7.)**
Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 588.
Bering Sea, 70 to 100 fathoms; British Columbia, 67 to 142 fathoms; Monterey Bay, California, 633 fathoms.

LATISIPHO APHELUS Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 323, pl. 6, fig. 7.
Chirikoff Island, Alaska, to San Diego, California, 290 to 626 fathoms.

LATISIPHO HALIBRECTUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 188; vol. 17, pl. 29, fig. 9.
Southern Bering Sea, near Unalaska Island, 351 to 399 fathoms.

LATISIPHO CLEMENTINUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 321.
Monterey Bay to San Diego, California, 339 to 704 fathoms.

LATISIPHO DALMASIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 322.
Off British Columbia in 238 fathoms.

Genus CHRYSODOMUS Swainson, 1840.

Section SULCOSIPHO Dall, 1916.

CHRYSODOMUS TABULATUS Baird, 1863.
Proc. Zool. Soc., p. 66; Proc. U. S. Nat. Mus., vol. 24, pl. 36, fig. 5, 1902.
British Columbia and south to San Diego, California, in 46 to 218 fathoms.

Section CHRYSODOMUS s. s.

CHRYSODOMUS AMIANTUS Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 321, pl. 5, fig. 10.
Pribilof Islands, Bering Sea, to Monterey Bay, California, 86 to 795 fathoms.

CHRYSODOMUS INSULARIS Dall, 1894.
Proc. U. S. Nat. Mus., vol. 17, p. 707, pl. 29, fig. 3.
Pribilof Islands, Bering Sea, 184 fathoms. Kuril Islands (var.?)

CHRYSODOMUS ONCODES Dall, 1907. **(Plate 9, fig. 8.)**
Smithsonian Misc. Coll., vol. 50, p. 155.
Petrel Bank, Bering Sea, 54 fathoms. Also the Kuril Islands, 229 fathoms.

CHRYSODOMUS ITHIUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 187; vol. 17, pl. 29, fig. 4, 1894.
Off Monterey, Cal., 204 to 382 fathoms.

CHRYSODOMUS SMIRNIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295. p. 322.
From Nunivak Island to Fuca Strait, 57 to 114 fathoms.

CHRYSODOMUS NUCEUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 322.
Arctic Ocean to Cooks Inlet, Alaska.

CHRYSODOMUS PHOENICEUS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 187; vol. 17, pl. 29, fig. 1, 1894.
Behm Canal, Alaska, to Cascade Head, Oregon.

CHRYSODOMUS BOREALIS Philippi, 1850.
Abb. u. Beschr., vol. 3, p. 118, *Fusus*, pl. 5, fig. 2.
Arctic Ocean to Avacha Bay, Kamchatka, the Aleutian Islands and eastward to the Shumagin Islands, Alaska; 14 to 110 fathoms.

CHRYSODOMUS PRIBILOFFENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 323.
Near Pribilof Islands, Bering Sea, in 52 to 87 fathoms; south and east to Kodiak Island, Alaska, and the Queen Charlotte Islands, British Columbia. Also Japan.

CHRYSODOMUS VINOSUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 323.
Western Bering Sea and Avacha Bay, 16 fathoms.

CHRYSODOMUS SATURUS Martyn, 1784.
Figs. Nondescript Shells, table 2, fig. 47.
Arctic Ocean from Point Barrow to Bering Strait; Plover Bay, south and east to Cape Douglas, Alaska.

CHRYSODOMUS SATURUS BERINGIANUS Middendorff, 1847.
Bull. Acad. St. Petersb., vol. 7, No. 16; Beitr. Mal. Ross., vol. 2, pl. 2, figs. 3, 4.
Plover Bay, near Bering Strait.

CHRYSODOMUS SATURUS ELATIOR Middendorff, 1848.
Sib. Reise, p. 225, pl. 10, fig. 3.
Norton Sound south to Unalashka, Alaska.

CHRYSODOMUS SATURUS COMMUNIS Middendorff, 1848.
Beitr. Mal. Ross., vol. 2, p. 131, pl. 5, figs. 5, 6.
Point Barrow, Arctic Ocean, to Bering Strait.

CHRYSODOMUS SATURUS TABULARIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 323.
Pribiloff and Nunivak Islands, Bering Sea.

CHRYSODOMUS SOLUTUS Hermann, 1781.
Der Naturforscher, vol. 16, p. 53, pl. 2, figs. 3, 4.
Mackenzie River delta west to Point Barrow and south to Bristol Bay, Bering Sea.

CHRYSODOMUS SOLUTUS VARICIFERUS Dall, 1920. (Plate 9, figs. 6, 7.)
Arctic Ocean, Okhotsk Sea.

CHRYSODOMUS LIRATUS Martyn, 1784.

Figs. Nondescript Shells, table 2, pl. 43.

Icy Cape, Arctic Ocean, south to Japan on the west, to Puget Sound on the east; and off Point Pinos, California, in 958 fathoms.

Genus SEARLESIA Harmer, 1915.

SEARLESIA DIRA Reeve, 1846. (Plate 8, fig. 1.)

Conch. Icon. *Buccinum*, fig. 92.

Chirikoff Island, Alaska, to Monterey, California, also in Pleistocene of Santa Barbara, California.

Family BUCCINIDAE.

Genus BUCCINUM Linnaeus, 1758.

BUCCINUM GLACIALE Linnaeus, 1761.

Fauna Suecica, ed. 2, p. 523.—Tryon, Man., vol. 3, pl. 76, fig. 345.

Circumboreal. Arctic Ocean to Fuca Strait.

BUCCINUM GLACIALE PARALLELUM Dall, 1919. (Plate 8, fig. 10.)

Proc. U. S. Nat. Mus., vol. 56, p. 231.

Pribilof and Aleutian Islands to Cooks Inlet. Also Kuril Islands.

BUCCINUM HERTZENSTEINI Verkruzen, 1882.

Jahrb. Mal. Ges., vol. 9, p. 214; Conch. Cab., ed. 2, pl. 89, fig. 1, 1883.

Western Bering Sea near Avacha Bay, in 58 fathoms.

BUCCINUM EUGRAMMATUM Dall, 1907. (Plate 12, fig. 2.)

Smithsonian Misc. Coll., vol. 50, No. 1727, p. 153.

Petrel Bank, Bering Sea, in 42 to 54 fathoms.

BUCCINUM TENUE Gray, 1839.

Zool. Beechey's Voy., p. 128, pl. 36, fig. 19.

Circumboreal. Arctic Ocean southward to Kamchatka to the west, the Aleutian Islands to the east and thence to Fuca Strait.

BUCCINUM TENUE RHODIUM Dall, 1919.

Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 324.

Plover Bay, near Bering Strait, 8 to 25 fathoms.

BUCCINUM TENUE LYPERUM Dall, 1919.

Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 324.

Southwestern Bering Sea in 100 fathoms.

BUCCINUM PLECTRUM Stimpson, 1865.

Canadian Nat., p. 374; Conch. Cab., ed. 2, pl. 91, fig. 2, 1883.

Point Barrow, Arctic Ocean, south to Puget Sound. Circumboreal.

BUCCINUM SOLENUM Dall, 1919.

Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 325.

Bering Sea, Nunivak Island, to north of Unimak Island, in 36 fathoms.

BUCCINUM HUMPHREYSIANUM Bennett, 1825.

Zool. Journ., vol. 1, p. 398; Jeffr. Brit. Conch., pl. 88, fig. 1.

"Northwest America" (Pease); exotic?

BUCCINUM OEDEMATUM Dall, 1907. (Plate 12, fig. 1.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 145.
Pribilof and Sannakh Islands, to Tahwit Head, Washington.

BUCCINUM POLARE Gray, 1839.
Zool. Beechey's Voy., p. 128; Conch. Cab., ed. 2, pl. 9, fig. 4, 1883.
Arctic Ocean and south in Bering Sea to Avacha Bay, Kamchatka, on the west, and to Alaska Peninsula on the east.

BUCCINUM CHARTIUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 325.
Off Pribilof Islands, in 688 fathoms. Also Japan.

BUCCINUM PEMPHIGUS Dall, 1907.
Smithsonian Misc. Coll., vol. 50, p. 151.
Western Bering Sea, off Avacha Bay, 682 fathoms.

BUCCINUM PEMPHIGUS MAJOR Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 325.
Western Bering Sea and south to Japan, 100 fathoms.

BUCCINUM PEMPHIGUS OROTUNDUM Dall, 1907. (Plate 12, fig. 9.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 152.
Nunivak, Pribilof, and Unimak Islands, Bering Sea.

BUCCINUM VIRIDUM Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 320, pl. 6, fig. 9.
Both coasts of Bering Sea from the Pribilof Islands southward to Santa Barbara Islands, California, in 414 fathoms.

BUCCINUM PLANETICUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 326.
From the Pribilof Islands, Bering Sea, to the Queen Charlotte Islands, British Columbia.

BUCCINUM DIPLODETUM Dall, 1907. (Plate 10, fig. 3.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 143.
Off Sitka, Alaska, 1,569 fathoms, and Sea Lion Rock, Washington, in 877 fathoms.

BUCCINUM CNISMATUM Dall, 1907. (Plate 10, fig. 2.)
Smithsonian Misc. Coll. vol. 50, No. 1727, p. 143.
Bering Sea, north of Unalaska, in 300 fathoms.

BUCCINUM KADIAKENSE Dall, 1907. (Plate 15, fig. 5.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 147.
Kodiak Islands, Alaska.

BUCCINUM BULIMULOIDEUM Dall, 1907. (Plate 15, fig. 2.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 150.
Near the Shumagin Islands, Alaska, in 159 fathoms.

BUCCINUM RONDINUM Dall, 1919. (Plate 12, fig. 3.)
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 326.
Southeastern Bering Sea off the peninsula of Alaska, in 159 fathoms.

BUCCINUM CASTANEUM Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 3; Proc. U. S. Nat. Mus., vol. 24, pl. 37, fig. 7, 1902.
Sannakh and Shumagin Islands, 20 to 41 fathoms.

BUCCINUM CASTANEUM FLUCTUATUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 327.
Pribilof Islands to Unimak Pass and the Shumagin Islands, Alaska, in 30 to 56 fathoms.

BUCCINUM CASTANEUM TRIPLOSTEPHANUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 327; vol. 24, pl. 37, fig. 9, 1902.
Kyska and Amchitka Islands, Aleutians, in 8 to 11 fathoms.

BUCCINUM CASTANEUM INCISULUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 327.
Western Bering Sea.

BUCCINUM PICTURATUM Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 8; Proc. U. S. Nat. Mus., vol. 24, pl. 37, fig. 8, 1902.
Aleutian Islands eastward to Bristol Bay and Kodiak Island, Alaska, 5 to 60 fathoms.

BUCCINUM SIMULATUM Dall, 1907. **(Plate 10, fig. 4.)**
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 150.
Petrel Bank, Bering Sea, 43 to 54 fathoms. Also northern Japan.

BUCCINUM OCHOTENSE Middendorff, 1848.
Sibirische Reise, p. 235, pl. 10, figs. 1, 2.
Arctic Ocean north of Bering Strait and the Okhotsk Sea.

BUCCINUM SIGMATOPLEURA Dall, 1907. **(Plate 12, fig. 6.)**
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 144.
Commander and Attu Islands; Bering Sea, in 135 fathoms.

BUCCINUM ROSSELLINUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 327.
Southeast of Chirikoff Island, Alaska, in 695 fathoms.

BUCCINUM STRIGILLATUM Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 186; vol. 17, pl. 27, fig. 9, 1894.
Fuca Strait (178 fathoms) to San Diego (822 fathoms) and Guadelupe Island.

BUCCINUM STRIGILLATUM FUCANUM Dall, 1907. **(Plate 12, fig. 12.)**
Smithsonian Misc. Coll., vol. 50, p. 152.
Straits of Fuca and Oregon coast.

BUCCINUM SERICATUM Hancock, 1846.
Ann. Mag. Nat. Hist., vol. 18, p. 328, pl. 4, fig. 7.
Arctic Ocean. Circumboreal.

BUCCINUM NORMALE Dall, 1885.
Rep. Polar Exp. Pt. Barrow, p. 179, pl. 3, fig. 1.
Arctic Ocean from Point Barrow to Kotzebue Sound.

BUCCINUM PHYSEMATUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 328.
Bernard Harbor, Arctic coast, west to Point Barrow and south to Bristol Bay, Alaska.

BUCCINUM ANGULOSUM Gray, 1839.
Zool. Beechey's Voy., p. 127, pl. 36, fig. 6.
Bernard Harbor, Arctic coast, west to Point Barrow and south to vicinity of Bering Strait.

BUCCINUM ANGULOSUM SUBCOSTATUM Dall, 1885.
Rep. Polar Exp. Pt. Barrow, p. 179, pl. 3, fig. 2.
Point Barrow.

BUCCINUM ANGULOSUM TRANSLIRATUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 328.
Point Barrow and southward to Bristol Bay.

BUCCINUM FRINGILLUM Dall, 1877.
Proc. Cal. Acad. Sci., vol. 7, p. 9; Conch. Cab., ed. 2, pl. 91, fig. 9, 1883.
North end of Nunivak Island, Bering Sea.

BUCCINUM TENELLUM Dall, 1883.
Conch. Cab., ed. 2, p. 88, pl. 91, fig. 8; Proc. U. S. Nat. Mus., vol. 24, p. 19, pl. 39, fig. 9.
Sea Horse Islands, Arctic Ocean, south to the Aleutian Islands.

BUCCINUM BAERI Middendorff, 1848.
Mal. Rossica, vol. 2, p. 148, pl. 6, figs. 7, 8.
Commander, Aleutian, and Kodiak Islands.

BUCCINUM BAERI MÖRCHIANUM Fischer, 1858.
Journ. de Conchyl., vol. 7, p. 299, pl. 10, fig. 2.
All coasts of Bering Sea south of the Pribilof Islands and eastward to Kodiak, Forrester Island, Alaska, and Port Simpson, British Columbia. Also in the Kuril Islands.

BUCCINUM FISCHERIANUM Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 106, pl. 16, fig. 13.
St. George Island, Pribilof group, Bering Sea.

BUCCINUM TENEBROSUM Hancock, 1846, variety?
Ann. Mag. Nat. Hist., vol. 18, p. 327.
Bering Strait. Circumboreal.

BUCCINUM CILIATUM Fabricius, 1780.
Fauna Grönl., p. 401; Conch. Cab., ed. 2, pl. 78, figs. 5, 8, 1883.
Circumboreal. From Point Barrow, Arctic Ocean, south to the Aleutian Islands and eastward to the Shumagins. On the Atlantic from Greenland to the Newfoundland banks.

BUCCINUM OVULUM Dall, 1894.
Proc. U. S. Nat. Mus., vol. 17, p. 707, pl. 30, fig. 6.
Amukhta Pass, Aleutians, in 248 fathoms.

BUCCINUM ALEUTICUM Dall, 1894.
Proc. U. S. Nat. Mus., vol. 17, p. 706, pl. 27, fig. 7.
Near Unimak Island, 59 fathoms.

BUCCINUM PERCRASSUM Dall, 1881.
Proc. U. S. Nat. Mus., vol. 9, p. 216; Conch. Cab., ed. 2, pl. 91, fig. 5.
Arctic Ocean north of Bering Strait.

BUCCINUM CHISHIMANUM Pilsbry, 1904.
Nautilus, vol 18, p. 87; Proc. Acad. Nat. Sci. Phila., 1905, pl. 3, fig. 20.
Bering Island, Bering Sea. Also Japan.

Genus VOLUTHARPA Fischer, 1856.

VOLUTHARPA PERRYI Jay, 1855.
Rep. Japan Exp., p. 295, pl. 5, figs. 13 to 15.
St. Paul Island, Bering Sea (Palmer). Also Japan.

VOLUTHARPA AMPULLACEA Middendorff, 1848.
Sibirische Reise, p. 237, pl. 17, figs. 1–3.
Bering Strait to Fuca Strait.

Family COLUBRARIIDAE.

Genus COLUBRARIA Schumacher, 1817.

COLUBRARIA, species (fragment).
Off La Jolla, San Diego County, California, in 199 fathoms.

Genus ENGINA Gray, 1839.

ENGINA CARBONARIA Reeve, 1846.
Conch. Iconica, *Ricinula*, fig. 22.
San Pedro, California, to Panama and the Galapagos Islands.

Family ALECTRIONIDAE.

Genus ALECTRION Montfort, 1810.

Subgenus SCHIZOPYGA Conrad, 1850.

SCHIZOPYGA FOSSATA Gould, 1849.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 152.—TRYON, Man., vol. 4, pl. 17, fig. 316.
Vancouver Island, south to Cerros Island, Lower California.

SCHIZOPYGA CALIFORNIANA Conrad, 1856. (Plate 11, fig. 4.)
Proc. Acad. Nat. Sci. Phila., p. 315; Pacific R. R. Reps., vol. 6, pl. 2, fig. 1.
Coast of Oregon south to San Ignacio Lagoon, Lower California. Also Pleistocene.

SCHIZOPYGA MENDICA Gould, 1849.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 155; Rep. U. S. Expl. Exp. Moll., pl. 19, fig. 331.
Kodiak Island, Alaska, south to Magdalena Bay, Lower California.

SCHIZOPYGA COOPERI Forbes, 1850.
Proc. Zool. Soc., p. 273, pl. 11, fig. 4.
Puget Sound to San Diego, California. Also Miocene.

SCHIZOPYGA CERRITENSIS Arnold, 1903.
Pal. San Pedro, p. 231, pl. 4, fig. 1.
Long Beach, California, to the Gulf of California. Also Pliocene.

SCHIZOPYGA PERPINGUIS Hinds, 1844.
Zool. *Sulphur's* Voy., p. 36, pl. 9, figs. 12, 13.
Puget Sound to Cerros Island, Lower California.

Subgenus ZEUXIS H. and A. Adams, 1853.

ZEUXIS INSCULPTUS Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 3, p. 223.—TRYON, Man., vol. 4, pl. 12, fig. 154.
Point Arena, California, to Cerros Island, Lower California.

ZEUXIS INSCULPTUS EUPLEURA Dall, 1916.
Proc. U. S. Nat. Mus., vol. 51, No. 2166, p. 576.
San Simeon, California, to Cerros Island, Lower California.

ZEUXIS NODICINCTUS Adams, 1851.
Proc. Zool. Soc., p. 110.
San Diego, California, to Panama and the Galapagos Islands.

ZEUXIS NODULIFERUS Philippi, 1848.
Zeitschr. Mal., p. 136; Abb. u. Beschr., *Buccinum*, pl. 1, fig. 3.
San Diego, California, to the Gulf of California.

ZEUXIS TEGULA Reeve, 1853.
Conch. Icon., *Nassa*, fig. 98.
San Francisco to San Diego, California.

Subgenus ILYANASSA Stimpson, 1865.

ILYANASSA OBSOLETA Say, 1822.
Journ. Acad. Nat. Sci. Phila., vol. 2, p. 232.—GOULD, Inv. Mass., pl. 15, fig. 210.
San Francisco, California, introduced with oysters from Atlantic Coast.

Family COLUMBELLIDAE.

Genus ANACHIS H. and A. Adams, 1853.

ANACHIS PENICILLATA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 398.—TRYON, Man., vol. 5, pl. 58, fig. 46.
Santa Barbara, California, to Gulf of California.

ANACHIS SUBTURRITA Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 223.—TRYON, Man., vol. 5, pl. 58, fig. 47.
San Pedro to San Diego, California.

Genus COLUMBELLA Lamarck, 1799.

Subgenus ALIA H. and A. Adams, 1853.

ALIA TUBEROSA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 398.—TRYON, Man., vol. 5, pl. 50, figs. 40, 41.
Forrester Island, Alaska, to Gulf of California.

ALIA GAUSAPATA Gould, 1850.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 170; Rep. U. S. Expl. Exp. Moll., pl. 19, fig. 337, 1852.
Port Etches, Alaska, to San Diego, California.

ALIA CARINATA Hinds, 1844.
Zool. Voy. *Sulphur*, Moll., p. 39, pl. 10, figs. 15–16.
San Francisco Bay to Cape San Lucas.

ALIA CARINATA HINDSI (Gaskoin) Reeve, 1858.
Conch. Icon. *Columbella*, fig. 143.
Monterey to San Diego, California.

ALIA CARINATA CALIFORNIANA Gaskoin, 1852.
Proc. Zool. Soc., p. 12.—Arnold, Pal. San Pedro, pl. 10, fig. 9, 1903.
Forrester Island, Alaska, to Salina Cruz, Mexico.

ALIA CALLIMORPHA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 330.
San Diego, California, to Magdalena Bay, Lower California.

ALIA CASCIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 300.
La Jolla, San Diego County, California.

Subgenus Astyris H. and A. Adams, 1853.

ASTYRIS ROSACEA Gould, 1840.
Amer. Journ. Sci., vol. 38, p. 197; Inv. Mass., p. 311, pl. 13, fig. 195, 1841.
Icy Cape, Arctic Ocean, south to Peril Straits, Alaska. Circumboreal.

ASTYRIS AMIANTIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 331.
Kyska Harbor, Aleutian Islands, Alaska.

ASTYRIS PERMODESTA Dall, 1890.
Proc. U. S. Nat. Mus., vol. 12, p. 327, pl. 5, fig. 4.
Unalaska, Aleutian Islands, south to San Diego, California, in deep water.

ASTYRIS AURANTIACA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 115, pl. 15, fig. 13.
Monterey, California, to Magdalena Bay, Lower California.

ASTYRIS HYPODRA Dall, 1916. (Plate 6, fig. 10.)
Nautilus, vol. 30, No. 3, p. 27; Proc. Cal. Acad. Sci., vol. 5, pl. 1, fig. 5.
Puget Sound to Puerto Libertad, West Mexico.

Genus NITIDELLA Swainson, 1840.

NITIDELLA GOULDII Carpenter, 1857.
Proc. Zool. Soc., p. 208.
Kodiak, Alaska, to San Diego, California.

?NITIDELLA LUCULENTA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 331.
Fuca Strait to Coronado Islands.

Genus AESOPUS Gould, 1860.

AESOPUS EURYTOIDES Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 47.
San Diego, California, to Panama.

AESOPUS CHRYSALLOIDES Carpenter, 1886.
Proc. Cal. Acad. Sci., vol. 3, p. 223.—ARNOLD, Pal. Cal., pl. 5, fig. 8.
San Pedro to San Diego, California.

AESOPUS SANCTUS Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 250.
Todos Santos Bay, Lower California.

AESOPUS MYRMECOÖN Dall, 1916.
Nautilus, vol. 30, No. 3, p. 27.
San Pedro to Point Abreojos, Lower California.

AESOPUS GOFORTHI Dall, 1912. **(Plate 9, fig. 4.)**
Nautilus, vol. 25, No. 11, p. 127.
Monterey, California (Goforth).

Genus AMPHISSA H. and A. Adams, 1853.

AMPHISSA COLUMBIANA Dall, 1916. **(Plate 6, fig. 9; plate 11, fig. 9.)**
Nautilus, vol. 30, No. 3, p. 27; Amer. Journ. Conch., vol. 7, pl. 16, fig. 9, 1871.
Chiachi Islands, Alaska, to San Pedro, California.

AMPHISSA VERSICOLOR Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 113, pl. 16, figs. 10, 11.
Oregon coast to Cerros Island, Lower California.

AMPHISSA VERSICOLOR INCISA Dall, 1919. **(Plate 11, fig. 10.)**
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 331.
Laguna Beach to San Diego, California.

AMPHISSA VERSICOLOR CYMATA Dall, 1916.
Nautilus, vol. 30, No. 3, p. 27.
Monterey, California.

AMPHISSA VERSICOLOR LINEATA Stearns, 1872.
Proc. Cal. Acad. Sci., vol. 4, p. 322, pl. 1, fig. 8.
Monterey, California.

AMPHISSA RETICULATA Dall, 1916.
Nautilus, vol. 30, No. 3, p. 27.
Port Althorp, Alaska, to San Diego, California.

AMPHISSA UNDATA Carpenter, 1864.
Suppl. Rep. Brit Assoc, p. 148; Proc. Cal. Acad. Sci., vol. 3, p. 158.—KEEP, West Coast Shells, fig. 163.
Monterey, California, to Cerros Island, Lower California.

AMPHISSA BICOLOR Dall, 1892.
Proc. U. S. Nat. Mus., vol. 15, p. 213, pl. 20, fig. 4.
Farallones Islands to San Diego, California, in deep water.

Family MURICIDAE.

Subfamily MURICINAE.

Genus MUREX Linnaeus, 1758.

Subgenus ALIPURPURA Bayle, 1884.

ALIPURPURA RHYSSA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 332.
Santa Barbara Islands, California, to Ballenas Lagoon, Lower California.

ALIPURPURA ERINACEOIDES Valenciennes, 1832.
HUMBOLDT and BONPLAND, Voy. Moll., vol. 2, p. 302.
San Diego, California, to Panama.

ALIPURPURA TRIALATA Sowerby, 1841.
Proc. Zool. Soc., p. 143 (not Kiener); Conch. Ill., *Murex*, fig. 18.
Bodega Bay, California, to Todos Santos Bay, Lower California.

Subgenus PTEROPURPURA Jousseaume, 1880.

PTEROPURPURA CARPENTERI Dall, 1899. (Plate 13, fig. 5.)
Nautilus, vol. 12, No. 12, p. 138; Proc. U. S. Nat. Mus., vol. 24, No. 1264, pl. 34, fig. 9, 1902.
Point Conception to San Diego, California.

PTEROPURPURA CARPENTERI TREMPERI (Hemphill) Dall, 1910.
Nautilus, vol. 24, No. 8, p. 96; Trans. San Diego Soc. Nat. Hist., vol. 1, No. 3, fig. 1, p. 100, 1911.
Newport Bay and San Pedro, California, in 35 fathoms.

PTEROPURPURA PETRI Dall, 1900.
Nautilus, vol. 14, No. 4, p. 37; Proc. U. S. Nat. Mus., vol. 24, pl. 34, fig. 7, 1902.
Santa Barbara to San Pedro, California.

Subgenus TRIREMIS Bayle, 1884.

TRIREMIS GEMMA Sowerby, 1879.
Thes. Conch., *Murex*, p. 32, pl. 22, fig. 214.
Santa Barbara, California, to Cerros Island, Lower California.

TRIREMIS SANTAROSANA Dall, 1905. (Plate 13, fig. 3, 4.)
Nautilus, vol. 19, No. 2, p. 14.
Santa Barbara Islands, California, to Cerros Island, Lower California.

TRIREMIS FESTIVA Hinds, 1843.
Zool. Voy. *Sulphur*, Moll., p. 9, pl. 3, figs. 13, 14.
Santa Barbara, California, to Cerros Island, Lower California.

Genus PURPURA Martyn, 1784.

PURPURA FOLIATA Martyn, 1784.
Ill. Nondescript Shells, table 2, pl. 66.
Sitka, Alaska, to San Diego, California.

PURPURA NUTTALLII Conrad, 1837.
Journ. Acad. Nat. Sci. Phila., vol. 7, p. 264, pl. 20, fig. 22.
Monterey, California, to Scammon Lagoon, Lower California.

PURPURA NUTTALLII ACICULIGER Valenciennes, 1846.
Voy. *Venus*, Atlas, pl. 10, fig. 1.
San Pedro, California, to Scammon Lagoon, Lower California.

PURPURA NUTTALLII ALBESCENS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 332.
San Pedro, California, to San Quentin Bay, Lower California.

PURPURA NUTTALLII ALBOFASCIATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 332.
San Pedro to San Diego, California.

Genus TRITONALIA Fleming, 1828.

TRITONALIA GRACILLIMA Stearns, 1871.
Conch. Mem., No. 6, p. 1; Amer. Journ. Conch., vol. 7, pl. 14, fig. 15.
Monterey, California, to San Geronimo, Island, Lower California.

TRITONALIA GRACILLIMA OBESA (Stearns MS.) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 333.
Monterey, California, to Gulf of California.

TRITONALIA LURIDA Middendorff, 1849.
Mal. Rossica, p. 150, pl. 4, figs. 4, 5; Proc. U. S. Nat. Mus., vol .15, pl. 20, fig. 7, 1892.
Forrester Island, Alaska, to Catalina Island, California.

TRITONALIA LURIDA ASPERA Baird, 1863. **(Plate 13, fig. 12.)**
Proc. Zool. Soc., p. 72.
Sitka, Alaska, to San Pedro, California.

TRITONALIA LURIDA MUNDA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 663; Proc. U. S. Nat. Mus., vol. 15, pl. 20, fig. 3, 1892.
Middleton Island, Alaska, to San Diego, California.

TRITONALIA LURIDA ROTUNDA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 333.
Moss Beach, to San Luis Obispo, California.

TRITONALIA SQUAMULIFERA Carpenter, 1868.
Gabb, Pal. Cal., vol. 2, p. 44.
Santa Barbara to San Pedro, California.

TRITONALIA FUSCONOTATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 333.
Monterey to Catalina Island, California.

TRITONALIA POULSONI Carpenter, 1865.
Journ. de Conchyl., ser. 3, vol. 5, p. 148.—Tryon, Man., vol. 1, pl. 38, fig. 475.
Santa Barbara, California, to Magdalena Bay, Lower California.

TRITONALIA PAINEI Dall, 1903. **(Plate 6, fig. 1.)**
Proc. Biol. Soc. Wash., vol. 16, p. 174.
Dundas Bay, Alaska, to San Diego, California.

TRITONALIA CIRCUMTEXTA Stearns, 1871.
Conch. Mem., No. 6, p. 1; Amer. Journ. Conch., vol. 7, pl. 14, fig. 14.
Trinidad to San Pedro, California.

TRITONALIA CIRCUMTEXTA CITRICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 334.
Santa Barbara Islands, to Scammon Lagoon, Lower California.

TRITONALIA INTERFOSSA Carpenter, 1864. (Plate 11, fig. 8.)
Proc. Acad. Nat. Sci. Phila., p. 64.—TRYON, Man., vol. 1, pl. 39, fig. 484.
Semidi Islands, Alaska, to San Diego, California.

TRITONALIA INTERFOSSA ALPHA (Carpenter) Dall, 1920. (Plate 13, fig. 9.)
This Bulletin.
Vancouver Island to Mendocino County, California.

TRITONALIA INTERFOSSA BETA (Carpenter) Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 250.
Monterey, California.

TRITONALIA INTERFOSSA CLATHRATA (Stearns) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 334.
Monterey to Catalina Island, California.

TRITONALIA INTERFOSSA MINOR Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 334.
Catalina Island, California.

TRITONALIA INTERFOSSA ATROPURPUREA (Carpenter) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 334.
Neah Bay, Washington, to San Diego, California.

TRITONALIA FOVEOLATA Hinds, 1843.
Proc. Zool. Soc., p. 127; Zool. Voy. *Sulphur*, Moll., pl. 3, figs. 15, 16.
Monterey to San Diego, California.

TRITONALIA STEARNSI Hemphill, 1911.
Trans. San Diego, Soc. Nat. Hist., vol. 1, No. 3, p. 100.
Monterey, California.

TRITONALIA SCLERA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 334.
Coast of Washington to Venice, California.

TRITONALIA SUBANGULATA Stearns, 1873.
Conch. Mem., No. 12, p. 5, pl. 1, fig 4; Proc. Cal. Acad. Sci., vol. 5, p. 81, pl. 1, fig. 4.
Monterey to Santa Barbara Islands.

TRITONALIA MICHAELI Ford, 1888.
Proc. Acad. Nat. Sci. Phila., 1888, p. 188, figs.
Orcas Island, Washington, to Gulf of California.

TRITONALIA FRASERI, Oldroyd, 1920.
Nautilus, vol. 33, p. 136, pl. 4, figs. 1, 2.
Departure Bay, Vancouver Island.

TRITONALIA BARBARENSIS Gabb, 1866. (Plate 6, fig. 5; plate 15, fig. 11.)
Proc. Cal. Acad. Sci., vol. 3, p. 183.
British Columbia to the Santa Barbara Islands, California.

TRITONALIA EPIPHANEA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 335.
San Pedro and Catalina Island, California.

? TRITONALIA TRACHEIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 335.
Sitka, Alaska, in 15 fathoms.

Genus UROSALPINX Stimpson, 1865.

UROSALPINX CINEREUS Say, 1822.
Journ. Acad. Nat. Sci. Phila., vol. 2, p. 236; Amer. Conch., vol. 3, pl. 29, 1831.
San Francisco Bay, to San Pedro, California, introduced with Atlantic seed oysters.

Genus EUPLEURA H. and A. Adams, 1853.

EUPLEURA GRIPPI Dall, 1911. (Plate 5, fig. 1.)
Nautilus, vol. 25, No. 8, p. 87.
San Diego, California, in 15 fathoms.

Genus TROPHON Montfort, 1810.

Subgenus AUSTROTROPHON Dall, 1903.

AUSTROTROPHON TRIANGULATUS Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 7, p. 224; Proc. U. S. Nat. Mus., vol. 14, pl. 5, figs. 1, 3, 6, 1891.
Catalina Island and San Pedro, California.

Subgenus NEPTUNEA (Bolten, part, 1798) Dall, 1902.

NEPTUNEA DALLI Kobelt, 1878.
Conch. Cab., ed. 2, *Trophon*, p. 275; Proc. U. S. Nat. Mus., vol. 9, pl. 4, fig. 6, 1886.
Arctic Ocean to Fuca Strait.

NEPTUNEA DALLI ALTA Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, p. 548.
Bering Sea.

NEPTUNEA SCITULA Dall, 1891. (Plate 13, fig. 6.)
Proc. U. S. Nat. Mus., vol. 14, p. 188; vol. 17, pl. 27, fig. 5, 1894.
Pribilof Islands to Unalaska Island, Bering Sea.

NEPTUNEA DISPARILIS Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 189; vol. 17, pl. 27, fig. 4, 1894.
Fuca Strait to Columbia River entrance.

NEPTUNEA ROTUNDATA Dall, 1902. (Plate 15, fig. 3.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 547.
Off Pribilof Islands, Bering Sea.

NEPTUNEA ELEGANTULA Dall, 1907. (Plate 6, fig. 6.)
Smithsonian Misc. Coll., vol. 50, No. 1727, p. 165.
Aleutian Islands, Alaska.

NEPTUNEA BERINGI Dall, 1902. (Plate 10, fig. 6.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 544.
Icy Cape, Arctic Ocean, to Puget Sound. Japan.

NEPTUNEA CEPULA Sowerby, 1880.
Thes. Conch., *Trophon*, p. 61, pl. 404, fig. 14, pl. 405, fig. 27.
Bering Sea and Aleutian Islands. Pleistocene of North Japan at Volcano Bay.

NEPTUNEA CYMATA Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 548.
Bering Sea.

NEPTUNEA ITHITOMA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 337.
Lynn Canal, Alaska.

NEPTUNEA ALASKANA Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 545.
Off Unalaska, Bering Sea, in 225 fathoms.

NEPTUNEA AVALONENSIS Dall, 1902. (Plate 8, fig. 8.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 546.
Catalina Island, California, to San Diego.

NEPTUNEA EUCYMATA Dall, 1902. (Plate 15, fig. 7.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 547.
Off San Diego, California.

NEPTUNEA BENTLEYI Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, No. 1610, p. 249.
Off San Diego, California, in 20 fathoms.

NEPTUNEA STAPHYLINA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 338.
Sitka, Alaska, to the Coronado Islands.

NEPTUNEA CALLICERATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 338.
Monterey to San Diego, California.

NEPTUNEA PACIFICA Dall, 1902. (Plate 11, fig. 5.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 544.
Arctic Ocean southward, on the west to Kamchatka and on the east in deep water to Acapulco, Mexico.

NEPTUNEA MULTICOSTATA Eschscholtz, 1829. (Plate 13, fig. 1.)
Zool. Atlas, pt. 2, p. 11, pl. 9, fig. 4.
Nunivak Island, Bering Sea, to San Pedro, California. Also Northern Japan.

NEPTUNEA PEREGRINA Dall, 1902. (Plate 8, fig. 5.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 543.
Catalina Island, California, in 16 fathoms.

NEPTUNEA MACOUNI Dall, 1910.
Canadian Geol. Surv., Mem. 14 N, No. 1143, p. 12, pl. 1, fig. 7.
Port Althorp, Alaska, to Barkley Sound, British Columbia.

NEPTUNEA ORPHEUS Gould, 1849. (Plate 6, fig. 7.)
Victoria, British Columbia, and off the Columbia River, Oregon.
Proc. Boston Soc. Nat. Hist., vol. 3, p. 142; Rept. U. S. Expl. Exp., Moll., fig. 285, 1852.

NEPTUNEA SMITHI Dall, 1902. (Plate 13, fig. 8.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 542.
Pribilof Islands, Bering Sea, to Santa Barbara Islands, California.

NEPTUNEA STUARTI E. A. Smith, 1880.
Proc. Zool. Soc., p. 481, pl. 48, fig. 6.
Shumagin Islands, Alaska, to San Diego, California.

Section TROPHONOPSIS Bucquoy, Dautzenberg, and Dollfus, 1882.

NEPTUNEA TENUISCULPTA Carpenter, 1866. (Plate 11, figs. 11, 12.)
Ann. Mag. Nat. Hist., ser. 3, vol. 17, p. 277.—TRYON, Man., vol. 2, p. 139, pl. 33, fig. 359, 1880.
Southeastern Bering Sea to Todos Santos Bay, Lower California.

NEPTUNEA CERRITENSIS Arnold, 1903.
Pal. San Pedro, p. 249, pl. 6, fig. 6.
Cerritos and San Pedro, California. Pleistocene.

NEPTUNEA PEDROANA Arnold, 1903.
Pal. San Pedro, p. 251, pl. 6, fig. 12.
San Pedro, California. Pleistocene and Pliocene.

NEPTUNEA LASIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 338.
Off Point Pinos, California, in 495 fathoms.

NEPTUNEA APOLYONIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 337.
Off Santa Barbara Islands, California, in 216 to 339 fathoms.

NEPTUNEA KAMCHATKANA Dall, 1902. (Plate 10, fig. 7.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 541.
Western Bering Sea, 100 fathoms.

NEPTUNEA TRIPHERA Dall, 1902. (Plate 15, figs. 8, 9.)
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 545.
Fuca Strait to San Diego, California, and off Piedras Blancas, Lower California, in 485 fathoms.

NEPTUNEA TOLOMIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 337.
San Miguel Island, California, in 376 fathoms.

Subfamily THAISINAE.

Genus THAIS Bolten, 1798.

Subgenus NUCELLA Bolten, 1798.

NUCELLA LAMELLOSA Gmelin, 1792.
Syst. Nat., vol. 7, p. 3498; Proc. U. S. Nat. Mus., vol. 49, p. 563, pl. 74, figs. 5–8.
Port Clarence, Bering Strait and southward on the west to Sado Island, Japan Sea, on the east to the Aleutian Islands, and Santa Barbara, California. Pliocene and Pleistocene of California and Oregon.

NUCELLA LAMELLOSA FRANCISCANA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 565, pl. 74, fig. 6.
San Francisco Bay, California.

NUCELLA LAMELLOSA HORMICA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 565, pl. 74, fig. 8.
Inner Harbor of Sitka, Alaska.

NUCELLA LAMELLOSA NEPTUNEA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 565.
Cook's Inlet, Alaska.

NUCELLA LAMELLOSA CYMICA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 565, pl. 74, fig. 5.
Surf-beaten rocks, coast of Washington.

NUCELLA LAMELLOSA SITKANA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 566, pl. 74, fig. 4.
Inner Harbor, Sitka, Alaska.

NUCELLA LIMA Martyn, 1784.
Ill. Nondescript Shells, table 2, pl. 46; Proc. U. S. Nat. Mus., vol. 49, pl. 75, figs. 4–6, 1915.
Kotzebue Sound, Arctic Ocean, south on the west to Bering Island, the Kuril Islands and Northern Japan, on the east to the Aleutian Islands, Alaska, Monterey, and San Diego, California, and Cerros Island, Lower California.

NUCELLA CANALICULATA Duclos, 1832.
Ann. Sci. Nat., vol. 26, p. 104, pl. 1, fig. 1.
The whole Aleutian chain, eastward to Sitka and southward to Monterey.

NUCELLA CANALICULATA ANALOGA Forbes, 1850.
Proc. Zool. Soc., p. 273, pl. 11, fig. 12.
California. (Forbes.)

NUCELLA CANALICULATA COMPRESSA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 569, pl. 74, fig. 2.
Monterey, California.

NUCELLA EMARGINATA Deshayes, 1839.
Revue Zool. Soc. Cuv., p. 360.—GUÉRIN, Mag. de Zool., 1841, pl. 25.
Bering Island and the Okhotsk Sea on the west; on the east from Hagmeister Island, Bering Sea, and southward to California, Mazatlan, and Topolobampo, Mexico.

NUCELLA EMARGINATA OSTRINA Gould, 1852.
Rept. U. S. Expl. Exp., Moll., p. 244, pl. 18, figs. 310 *a–b*.
Tillamook, Oregon.

NUCELLA EMARGINATA PROJECTA Dall, 1915.
Proc. U. S. Nat. Mus., vol. 44, p. 571, pl. 75, fig. 3.
Sitka, Alaska.

Genus ACANTHINA Fischer, 1807.

Subgenus ACANTHINUCELLA Cooke, 1918.

ACANTHINUCELLA SPIRATA Blainville, 1832.
Nouv. Ann. du Mus. Paris, vol. 1, p. 252, pl. 12, fig. 8.
Puget Sound to San Diego, California, and Socorro Island.

ACANTHINUCELLA SPIRATA PUNCTULATA Sowerby, 1835.
Conch. Illustr. *Monoceros*, fig. 3.
Monterey, California, to San Tomas, Lower California, and Socorro.

ACANTHINUCELLA SPIRATA AURANTIA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, No. 1610, p. 248.
Newport and San Pedro, California.

ACANTHINUCELLA PAUCILIRATA Stearns, 1871.
Conch. Memo., No. 6, p. 1; Amer. Journ. Conch., vol. 7, p. 167, pl. 14, fig. 16.
San Pedro, California, to Cerros Island, Lower California.

Subgenus ACANTHINA s. s.

ACANTHINA LUGUBRIS Sowerby, 1822.
Gen. Shells, *Monoceros*, fig. 3; Conch. Ill., fig. 11, 1835.
San Diego, California (Ritchie), to Magdalena Bay, Lower California, and the Galapagos Islands.

Genus FORRERIA Jousseaume, 1880.

FORRERIA BELCHERI Hinds, 1843.
Proc. Zool. Soc., p. 127; Zool. Voy. *Sulphur*, Moll., pl. 2, figs. 1-3, 1844.
San Pedro, California, to Scammon Lagoon, Lower California.

Family CORALLIOPHILIDAE.

Genus CORALLIOPHILA H. and A. Adams, 1853.

Subgenus PSEUDOMUREX Monterosato, 1872.

PSEUDOMUREX COSTATA Blainville, 1832.
Nouv. Ann. du Mus. Paris, vol. 1, p. 232, pl. 11, fig. 8.
San Miguel Island, California, to Panama.

PSEUDOMUREX HINDSII Carpenter, 1857.
Mazatlan Cat., p. 205; Zool. Voy. *Sulphur*, Moll., pl. 1, figs. 16, 17.
Point Conception, California, to San Diego, and Panama.

PSEUDOMUREX KINCAIDI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 339.
Puget Sound (Kincaid).

Suborder STREPTODONTA.

Superfamily PTENOGLOSSA.

Family EPITONIIDAE.

Genus EPITONIUM Bolten, 1798.

Subgenus OPALIA H. and A. Adams, 1853.

OPALIA WROBLEWSKII Mörch, 1876.
Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 8, p. 190; Rept. U. S. Expl. Exp., Moll., p. 207, 1852.—KEEP, West Coast Shells, p. 182, fig. 173, 1911.
Forrester Island, Alaska, to San Diego, California.

OPALIA EVICTA De Boury, 1919.
Journ. de Conchyl., vol. 44, No. 1, p. 36.
Forrester Island, Alaska, to Magdalena Bay, Lower California.

Subgenus Dentiscala De Boury, 1886.

DENTISCALA CRENIMARGINATA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, p. 473.
Monterey, California, to Puerto Libertad, West Mexico.

DENTISCALA NESIOTICA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, p. 473.
Catalina Island, California.

Subgenus Nodiscala De Boury, 1889.

NODISCALA SPONGIOSA Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 3, p. 222; Suppl. Rep. Brit. Assoc., p. 660.
Off Oregon coast in 50 fathoms to Monterey, California.

NODISCALA RETIPOROSA Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 3, p. 222; Suppl. Rep. Brit. Assoc., p. 660.
Catalina Island, California, to Gulf of California.

Subgenus Acirsa Mörch, 1857.

ACIRSA BOREALIS (Beck) Lyell, 1839. **(Plate 13, fig. 10.)**
Rising of Sweden, p. 37, pl. 2, figs. 11–12.
Aleutian Islands, Alaska. Circumboreal.

ACIRSA BOREALIS OCHOTENSIS Middendorff, 1849.
Mal. Rossica, vol. 2, p. 98; Sibirische Reise, p. 213, pl. 12, figs. 12–14.
Arctic Ocean near Bering Strait, Bering Sea, and the Okhotsk Sea.

Subgenus Boreoscala Kobelt, 1902.

BOREOSCALA GREENLANDICA Perry, 1811.
Conchology, pl. 28, fig. 8.
Arctic Ocean near Point Barrow and southward on the west to northern Japan; on the east to Wrangell, Alaska. Circumboreal. Also Pliocene.

Subgenus Asperoscala De Boury, 1909.

ASPEROSCALA BELLASTRIATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 660; Proc. Cal. Acad. Sci., vol. 3, p. 221, 1866.—Arnold, Pal. San Pedro, pl. 9, fig. 17.
Monterey to San Diego, California.

ASPEROSCALA LOWEI Dall, 1906. **(Plate 6, fig. 11.)**
Nautilus, vol. 20, No. 4, p. 44.
Catalina Island, California.

ASPEROSCALA COOKEANA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 475.
San Diego, California.

ASPEROSCALA ARNOLDI Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 475.
San Pedro, California.

ASPEROSCALA LAGUNARUM Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 477.
Laguna Beach, California.

Subgenus CIRSOTREMA Mörch, 1852.

? CIRSOTREMA MONTEREYENSIS Dall, 1907.
Nautilus, vol. 20, No. 11, p. 128.
Monterey to San Pedro, California.

Subgenus NITIDOSCALA De Boury, 1909.

NITIDOSCALA INDIANORUM Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 28.—TRYON, Man., vol. 9, pl. 14, fig. 48.
Forrester Island, Alaska, to Todos Santos Bay, Lower California.

NITIDOSCALA TINCTA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 28.—TRYON, Man., vol. 9, pl. 14, fig. 49.
Monterey, California, to the Gulf of California.

NITIDOSCALA FALLACIOSA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 478.—KEEP, West Coast Shells, p. 183, fig. 174.
Monterey, California, to Gulf of California.

NITIDOSCALA PERSUTURA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 478.
San Diego, California.

NITIDOSCALA SUBCORONATA Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 221.
Vancouver Island to San Diego, California.

NITIDOSCALA DENSICLATHRATA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 478.
Neah Bay, Washington, to San Diego, California.

NITIDOSCALA CREBRICOSTATA Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 222.
Vancouver Island to Gulf of California.

NITIDOSCALA HEXAGONA Sowerby, 1844.
Proc. Zool. Soc., p. 29; Thes. Conch., vol. 1, p. 98, pl. 33, fig. 67, 1847.
Santa Cruz, California, to Panama.

NITIDOSCALA? TIARA Carpenter, 1856.
Proc. Zool. Soc., p. 164.
Catalina Island, California, to Todos Santos Bay, Lower California. Panama ?

NITIDOSCALA COLUMBIANA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 481.
Off Columbia River, Oregon, to Gulf of California.

NITIDOSCALA SAWINAE Dall, 1903. (Plate 6, fig. 12.)
Proc. Biol. Soc. Wash., vol. 16, p. 175.
Monterey to Catalina Island, California.

NITIDOSCALA CATALINENSIS Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 481.
Catalina, Island, California.

NITIDOSCALA CALIFORNICA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 482.
San Miguel Island, California, to Gulf of California.

NITIDOSCALA RECTILAMINATA Dall, 1907.
Nautilus, vol. 20, No. 11, p. 127; Proc. U. S. Nat. Mus., vol. 53, p. 482.
Monterey, California, to Gulf of California.

NITIDOSCALA CAAMANOI Dall and Bartsch, 1910.
Canada Geol. Surv. Mem. 14 N., No. 1143, p. 13, pl. 1, fig. 1.
Vancouver Island to San Pedro, California.

NITIDOSCALA REGIOMONTANA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 481.
Monterey Bay, in 30 fathoms.

NITIDOSCALA BERRYI Dall, 1907.
Nautilus, vol. 20, No. 11, p. 127.
Monterey to San Diego, California.

NITIDOSCALA INCONSPICUA Sowerby, 1847.
Thes. Conch., vol. 1, p. 90, pl. 33, fig. 53.
Off San Diego, California, in 75 fathoms.

NITIDOSCALA DIEGENSIS Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 483.
San Diego, California, to the Gulf of California.

Section CRISPOSCALA De Boury, 1909.

NITIDOSCALA CATALINAE Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, No. 1610, p. 252.
Forrester Island, Alaska, to San Diego, California.

NITIDOSCALA REGUM Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 484.
Point Reyes to San Diego, California.

NITIDOSCALA TABULATA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 483.
San Pedro, California, to Coronado Islands.

NITIDOSCALA ACROSTEPHANUS Dall, 1908.
Proc. U. S. Nat. Mus., vol. 24, No. 1610, p. 251.
Monterey, California, to Coronado Islands.

Section GLOBISCALA De Boury, 1909.

NITIDOSCALA ORCUTTIANA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 484.
San Diego, California.

NITIDOSCALA BARBARINA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 341.
San Diego, California, to Panama.

NITIDOSCALA ZEPHYRIA Dall, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2217, p. 485.
San Diego, California.

Family JANTHINIDAE.

Genus JANTHINA Bolten, 1798.

JANTHINA GLOBOSA Swainson, 1822.
Zool. Ill., ser. 1, vol. 2, pl. 85.
Puget Sound to Gulf of California. Pelagic.

JANTHINA CERULEATA Reeve, 1858.
Conch. Icon., *Janthina*, fig. 7.
San Diego, California. Pelagic.

JANTHINA EXIGUA Lamarck, 1822.
Anim. Sans. Vert., ser. 1, vol. 6, p. 206.—TRYON, Man., vol. 9, p. 37, pl. 10, fig. 17.
Catalina Island, California, to West Mexico. Pelagic.

Superfamily GYMNOGLOSSA.

Family MELANELLIDAE.

Genus MELANELLA Bowdich, 1822.

Section MELANELLA s. s.

MELANELLA MONTEREYENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 320, pl. 39, fig. 6.
Trinidad to Monterey Bay, California.

MELANELLA PENINSULARIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 320, pl. 39, fig. 4.
San Diego, California, to Magdalena Bay, Lower California.

MELANELLA LASTRA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 321, pl. 40, fig. 3.
San Pedro, California, to Magdalena Bay, Lower California.

MELANELLA THERSITES Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 659; Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 396; Proc. U. S. Nat. Mus., vol. 53, No. 2207, pl. 41, figs. 1, 2, 3.
Monterey, California, to San Geronimo Island, Lower California.

MELANELLA COLUMBIANA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 324, pl. 41, fig. 5.
Baranoff Island, Alaska, to Departure Bay, British Columbia.

MELANELLA COMOXENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 325, pl. 41, fig. 4.
Comox, Vancouver Island, British Columbia.

MELANELLA MACRA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 326, pl. 41, fig. 6.
Departure Bay, British Columbia, to Seattle, Washington.

MELANELLA BERRYI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 326, pl. 42, fig. 3.
Monterey Bay to Catalina Island, California.

MELANELLA GRIPPI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 327, pl. 42, fig. 5.
San Pedro, California, to Point Abreojos, Lower California.

MELANELLA CATALINENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 329, pl. 40, fig. 7.
San Rosa Island, California, to San Hipolito Point, Lower California.

Section EULIMA Risso, 1826.

MELANELLA MICANS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 659; Proc. Acad. Nat. Sci. Phila., 1865, p. 63; Proc. U. S. Nat. Mus., vol. 53, p. 303, pl. 34, figs. 1–6.
Vancouver Island to Point Abreojos, Lower California. Also Pleistocene and Pliocene.

MELANELLA MICANS BOREALIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 305, pl. 35, fig. 7.
Kodiak Island, Alaska, to Vancouver Island, British Columbia.

MELANELLA RUTILA Carpenter, 1864.
Suppl. Brit. Assoc., p. 659; Proc. Cal. Acad. Sci., vol. 3, p. 221; Proc. U. S. Nat. Mus., vol. 53, No. 2207, pl. 35, figs. 2, 3, 6.
Vancouver Island, British Columbia, to Magdalena Bay, Lower California. Also Pleistocene and Pliocene.

MELANELLA OLDROYDI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 309, pl. 36, figs. 5, 6, 7.
San Pedro to Point Abreojos, Lower California. Also Pliocene and Pleistocene.

MELANELLA RANDOLPHI Vanatta, 1899.
Proc. Acad. Nat. Sci. Phila., p. 256, pl. 11, figs. 13, 14.
Aleutian Islands to Puget Sound.

MELANELLA CALIFORNICA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 313, pl. 37, fig. 1.
Catalina Island and San Martin, California.

MELANELLA HEMPHILLI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 313, pl. 37, fig. 6.
San Diego, California, to Point Abreojos, Lower California.

MELANELLA COMPACTA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 659; Proc. Cal. Acad. Sci., vol. 3, p. 221; Proc. U. S. Nat. Mus., vol. 53, No. 2207, pl. 37, fig. 3.
San Pedro, California, to Point Abreojos, Lower California.

MELANELLA TACOMAËNSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 316, pl. 38, fig. 5.
Tacoma, Washington.

Subgenus SABINELLA Monterosato, 1890.

SABINELLA BAKERI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 334, pl. 43, fig. 5.
San Diego, California.

SABINELLA PTILOCRINICOLA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 555, pl. 53; vol. 53, p. 335, pl. 44, fig. 2, 1917.
Parasitic on *Ptilocrinus*, in 1,588 fathoms, off British Columbia.

Genus ENTOCOLAX Voight, 1888.

ENTOCOLAX LUDWIGI Voight, 1888.
Zeitschr. Wiss. Zool., vol. 47, p. 658, pl. 41–43.
Bering Sea, parasite of *Myriotrochus*.

Genus CYTHNA Carpenter, 1864.

CYTHNA ALBIDA Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 3, p. 219.
Southern California. Parasitic on starfishes.

Genus HALIELLA Monterosato, 1873.

HALIELLA ABYSSICOLA Bartsch, 1908.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 336, pl. 43, fig. 8.
In 822 fathoms off San Diego, California, and southward to latitude 27° north, off Point Pablo, Lower California, in 284 fathoms.

HALIELLA LOMANA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 253; vol. 53, p. 337, pl. 44, fig. 1.
Off Point Loma, San Diego County, California, in 650 fathoms.

Genus STROMBIFORMIS Da Costa, 1778.

STROMBIFORMIS ALASKENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 339, pl. 45, fig. 1.
Dutch Harbor, Unalaska, Aleutian Islands.

STROMBIFORMIS CALIFORNICUS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 340, pl. 45, fig. 5.
Catalina Island, to San Diego, California.

STROMBIFORMIS ALMO Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 342, pl. 46, fig. 5
Santa Rosa Island to San Diego, California.

Genus ACLIS Lovèn, 1846.

Subgenus GRAPHIS Jeffreys, 1869.

GRAPHIS SHEPARDIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 342.
San Pedro to San Diego, California.

Subgenus Aclis s. s.

? ACLIS TURRITA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 657; Proc. Cal. Acad. Sci., vol. 3, p. 219, 1866; Proc. U. S. Nat. Mus., vol. 39, pl. 62, fig. 4.
San Pedro, California.

? ACLIS OCCIDENTALIS Hemphill, 1894.
Zoë, vol. 4, No. 4, p. 395; Proc. U. S. Nat. Mus., vol. 39, pl. 62, fig. 2.
San Diego, California.

Genus NISO Risso, 1826.

NISO LOMANA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 350, pl. 49, fig. 4.
Santa Rosa Island to Point Loma, California.

NISO HIPOLITENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 53, No. 2207, p. 350, pl. 49, fig. 5.
San Diego, California, to San Hipolito Point, Lower California.

Family PYRAMIDELLIDAE.

Genus PYRAMIDELLA Lamarck, 1799.

Subgenus Longchaeus Mörch, 1875.

LONGCHAEUS ADAMSI Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 546; U. S. Nat. Mus., Bull. 68, p. 21, pl. 1, figs. 6, 6*a*, 1909.
Monterey, California, to Mazatlan, Mexico.

LONGCHAEUS MEXICANUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 23, pl. 1, fig. 12.
San Diego, California, to Scammon Lagoon, Lower California.

LONGCHAEUS MAZATLANICUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 24, pl. 1, fig. 7.
San Diego, California, to Cape Tepoca, western Mexico.

Subgenus Pharcidella Dall, 1889.

PHARCIDELLA ACHATES Gould, 1852.
Boston Journ. Nat Hist., vol. 6, p. 385, pl. 14, fig. 13.
? Santa Barbara, California (Jewett). Mazatlan, Mexico.

Genus TURBONILLA Risso, 1826.

TURBONILLA GILLI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 493, pl. 14, fig. 5.
Catalina Island to San Diego, California.

TURBONILLA GILLI DELMONTENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 494, pl. 14, fig. 7.
Monterey Bay, California.

TURBONILLA DIEGENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 31, pl. 2, fig. 13.
San Pedro to San Diego, California.

TURBONILLA ACRA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 32, pl. 2, fig. 14.
Catalina Island, California.

Subgenus CHEMNITZIA Orbigny, 1839.

CHEMNITZIA HYPOLISPA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 34, pl. 2, fig. 5.
Catalina Island to San Diego, California.

CHEMNITZIA AEPYNOTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 35, pl. 2, fig. 10.
San Pedro, California, to San Martin Island, Lower California.

CHEMNITZIA ENGBERGI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Juan Islands, Gulf of Georgia.

CHEMNITZIA GABBIANA Cooper, 1870.
Amer. Journ. Conch., vol. 6, p. 66.
Monterey, California.

CHEMNITZIA SANTAROSANA Dall and Bartsch, 1909.
U. S. Nat. Mus. Bull. 68, p. 36, pl. 2, fig. 7.
Santa Rosa Island to San Diego, California.

CHEMNITZIA CLARINDA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 264, pl. 35, fig. 4.
San Diego, California.

CHEMNITZIA MURICATOIDES Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 495, pl. 14, fig. 2.
Monterey, California.

CHEMNITZIA KELSEYI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 39, pl. 2, fig. 16.
Santa Barbara, California, to San Ignacio, Lower California.

CHEMNITZIA RAYMONDI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 39, pl. 2, fig. 17.
Santa Rosa Island to San Diego, California.

Subgenus STRIOTURBONILLA Sacco, 1892.

STRIOTURBONILLA DINORA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 264, pl. 35, fig. 8.
San Diego, California.

STRIOTURBONILLA BUTTONI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 43, pl. 3, fig. 4.
Santa Rosa Island, California, to Point Abreojos, Lower California.

STRIOTURBONILLA VANCOUVERENSIS Baird, 1863.
Proc. Zool. Soc., p. 67; Proc. U. S. Nat. Mus., vol. 30, p. 495, pl. 44, fig. 1, 1907.
Port Etches, Alaska, to Puget Sound.

STRIOTURBONILLA CANADENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, No. 2193, p. 640, pl. 44, fig. 11.
Forrester Island, Alaska.

STRIOTURBONILLA ASSER Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 45, pl. 3, fig. 1.
Redondo Beach to San Diego, California.

STRIOTURBONILLA ATTRITA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 46, pl. 4, fig. 11.
San Pedro to San Diego, California.

STRIOTURBONILLA ENCELLA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 265, pl. 35, fig. 1.
San Pedro, California.

STRIOTURBONILLA BAKERI Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 265, pl. 35, fig. 10.
San Diego Bay, California.

STRIOTURBONILLA TORQUATA Gould, 1852.
Boston Journ. Nat. Hist., vol. 6, p. 384, pl. 14, fig. 16.
Point Fermin to San Diego, California.

STRIOTURBONILLA STYLINA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 396; U. S. Nat. Mus., Bull. 68, pl. 3, fig. 7.
Monterey to the Coronado Islands.

STRIOTURBONILLA CARPENTERI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 49, pl. 3, fig. 9.
San Pedro, California.

STRIOTURBONILLA SIMPSONI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 49, pl. 3, fig. 6.
Off Redondo to San Diego, California.

STRIOTURBONILLA PROFUNDICOLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 50, pl. 3, fig. 11.
Off Catalina Island to San Diego, California, 197 fathoms.

STRIOTURBONILLA GALIANOI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 51, pl. 4, fig. 12.
San Diego, California, to Cape San Lucas.

STRIOTURBONILLA HUMEROSA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 52, pl. 3, fig. 10.
Catalina Island to San Diego, California.

STRIOTURBONILLA SERRAE Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 497, pl. 44, fig. 8; Bull. 68, p. 53, pl. 4, fig. 3.
Monterey, California.

STRIOTURBONILLA BARKLEYENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, No. 2193, p. 641, pl. 42, fig. 8; pl. 44, fig. 9.
Barkley Sound, Vancouver Island, British Columbia.

STRIOTURBONILLA DRACONA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 66, pl. 35, fig. 2.
San Diego, California.

STRIOTURBONILLA ARESTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 54, pl. 4, fig. 5.
Santa Rosa Island to San Diego, California.

Subgenus PYRGOLAMPROS Sacco, 1892.

PYRGOLAMPROS VICTORIANA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 3, p. 501, pl. 44, fig. 6; U. S. Nat. Mus., Bull. 68, p. 61, pl. 5, fig. 3.
Vancouver Island, British Columbia.

PYRGOLAMPROS RIDGWAYI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull 68, p. 62, pl. 6, fig. 10.
San Diego, California.

PYRGOLAMPROS VALDEZI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 502, pl. 44, fig. 3; U. S. Nat Mus., Bull. 68, p. 62, pl. 6, fig. 8.
Barkley Sound, Vancouver Island, to Monterey, California.

PYRGOLAMPROS NEWCOMBEI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 503, pl. 45, fig. 6.
Port Simpson to Victoria, British Columbia.

PYRGOLAMPROS TAYLORI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 499, pl. 44, fig. 9.
Port Simpson to Vancouver Island, British Columbia.

PYRGOLAMPROS TALMA Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14 N., p. 13, pl. 2, fig. 3.
Barkley Sound, Vancouver, Island.

PYRGOLAMPROS LOWEI Dall and Bartsch, 1903.
Mem. Cal. Acad. Sci., vol. 3, p. 278, pl. 1, figs. 5, *5a*.
San Pedro to San Diego, California.

PYRGOLAMPROS HALIBRECTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 65, pl. 5, fig. 10.
Catalina Island, California.

PYRGOLAMPROS GOULDI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 66, pl. 6, fig. 1.
Santa Rosa Island to San Diego, California.

PYRGOLAMPROS AURANTIA Carpenter, 1865.
Journ. de Conchyl., ser. 3, vol. 5, p. 147; U. S. Nat. Mus., Bull. 68, pl. 6, fig. 4.
Departure Bay, Victoria, British Columbia, and Puget Sound.

PYRGOLAMPROS PEDROANA Dall and Bartsch, 1903.
Mem. Cal. Acad. Sci., vol. 3, 279, pl. 2, fig. 3.
Victoria, British Columbia, to San Diego, California.

PYRGOLAMPROS HALIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 68, pl. 5, fig. 11.
Santa Barbara to San Diego, California.

PYRGOLAMPROS LYALLI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 500, pl. 44, fig. 4.
Banks Island, British Columbia.

PYRGOLAMPROS BERRYI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 500, pl. 44, fig. 10.
Monterey Bay to Catalina Island, California.

PYRGOLAMPROS PUGETENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, No. 2193, p. 647, pl. 44, fig. 4.
Puget Sound.

PYRGOLAMPROS TREMPERI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, No. 2193, p. 647, pl. 44, fig. 7.
Off San Diego Bay, 15 fathoms.

PYRGOLAMPROS ALASKANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 70, pl. 6, fig. 9.
Kodiak to Sitka Harbor, Alaska.

PYRGOLAMPROS CHOCOLATA Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 220; U. S. Nat. Mus., Bull. 68, p. 70, pl. 5, fig. 9.
San Pedro, California.

PYRGOLAMPROS PAINEI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 71, pl. 5. fig. 4.
Redondo Beach to San Diego, California.

PYRGOLAMPROS KEEPI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 71, pl. 5, fig. 1.
Long Beach to San Diego, California.

PYRGOLAMPROS HALISTREPTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 72, pl. 5, fig. 2.
Off Newport, California.

PYRGOLAMPROS LITUYANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 72, pl. 5, fig. 8.
Lituya Bay, Alaska.

PYRGOLAMPROS OREGONENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 503, pl. 45, fig. 2.
Off the coast of Washington and Oregon in 30 fathoms.

PYRGOLAMPROS GLORIOSA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 268, pl. 35, fig. 9.
Off San Diego, California, in 12 fathoms.

PYRGOLAMPROS MACOUNI Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, p. 15, pl. 1, fig. 9.
Barkley Sound, Vancouver Island.

PYRGOLAMPROS PESA Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, p. 14, pl. 2, fig. 5.
Barkley Sound, Vancouver Island.

PYRGOLAMPROS RINELLA Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, p. 14, pl. 1, fig. 2.
Barkley Sound, Vancouver Island.

PYRGOLAMPROS FRANCISCANA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, No. 2193, p. 645, pl. 42, fig. 2.
San Francisco Bay, California.

Subgenus PYRGISCUS Philippi, 1841.

PYRGISCUS VEXATIVUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 77, pl. 7, fig. 11.
San Pedro to San Diego, California.

PYRGISCUS OBESUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 78, pl. 7, fig. 3.
Pacific Beach, San Diego County, California.

PYRGISCUS NUTTINGI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 79, pl. 7, fig. 13.
Off San Pedro and San Diego, California, 15 to 20 fathoms.

PYRGISCUS CALLIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 80, pl. 7, fig. 4.
San Diego, California.

PYRGISCUS PLUTO Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 81, pl. 9, fig. 9.
San Pedro, California.

PYRGISCUS JEWETTI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 82, pl. 7, fig. 2.
San Pedro, California, to San Hipolito Point, Lower California.

PYRGISCUS DORA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 649, pl. 42, fig. 10.
San Diego, California.

PYRGISCUS INA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 649, pl. 44, fig. 10.
San Diego, California.

PYRGISCUS ISTA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 650, pl. 42, fig. 6.
San Diego, California.

PYRGISCUS EVA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 651, pl. 44, fig. 6.
San Diego, California.

PYRGISCUS SIGNAE Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 83, pl. 7, fig. 1.
San Pedro, California.

PYRGISCUS MÖRCHI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 505, pl. 45, fig. 1.
Redondo Beach to San Diego, California.

PYRGISCUS ARAGONI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 85, pl. 9, fig. 12.
Monterey Bay, in 20 fathoms.

PYRGISCUS RECTUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 85, pl. 7, fig. 12.
San Diego, California, to Point Abreojos, Lower California.

PYRGISCUS WELDI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 86, pl. 8, fig. 11.
Off Point Fermin, California.

PYRGISCUS NEREIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 86, pl. 8, fig. 1.
San Pedro to San Diego, California.

PYRGISCUS ANTESTRIATUS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 506, pl. 45, fig. 5.
Esteros Bay to San Diego, California.

PYRGISCUS ANTEMUNDUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 88, pl. 8, fig. 15.
Santa Rosa and Santa Catalina Islands, California.

PYRGISCUS TENUICULUS Gould, 1853.
Boston Journ. Nat. Hist., vol. 6, p. 383, pl. 14, fig. 15.
Monterey, California, to Point Abreojos, Lower California.

PYRGISCUS VIRGO Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 396; U. S. Nat. Mus., Bull. 68, pl. 8, fig. 4.
Santa Barbara, California.

PYRGISCUS CALLIMENE Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, No. 1903, p. 271, pl. 36, fig. 7.
San Diego, California.

PYRGISCUS CANFIELDI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 504, pl. 47, fig. 4.
Monterey Bay, California.

PYRGISCUS ALMO Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 95, pl. 9, fig. 8.
San Diego, California.

PYRGISCUS GRIPPI Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 270, pl. 36, fig. 9.
San Diego, California.

PYRGISCUS EUCOSMOBASIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 507, pl. 45, fig. 8.
San Luis Obispo to San Diego, California.

PYRGISCUS AURICOMA Dall and Bartsch, 1903.
Mem. Cal. Acad. Sci., vol. 3, p. 274, pl. 1, fig. 4.
San Pedro, California, and Scammon Lagoon, Lower California.

PYRGISCUS CASTANEUS Keep, 1888.
West Coast Shells, p. 52, fig. 33; U. S. Nat. Mus., Bull. 68, pl. 9, fig. 1.
San Pedro to San Diego, California.

PYRGISCUS CASTANELLUS Dall, 1908.
Nautilus, vol. 22, p. 131; Proc. U. S. Nat. Mus., p. 102, pl. 9, fig. 7, 1909.
Monterey, California.

PYRGISCUS WICKHAMI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 106, pl. 10, fig. 9.
Catalina Island, California.

PYRGISCUS ADUSTUS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 108, pl. 10, fig. 12.
San Diego, California.

Subgenus MORMULA A. Adams, 1854.

MORMULA LORDI E. A. Smith, 1880.
Ann. Mag. Nat. Hist., ser. 5, vol. 6, p. 288; U. S. Nat. Mus., Bull. 68, pl. 11, fig. 4.
Sitka, Alaska, to Puget Sound.

MORMULA REGINA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 112, pl. 11, fig. 1.
Santa Rosa Island to Catalina Island, California.

MORMULA CATALINENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 113, pl. 11, fig. 10.
Catalina Island, California.

MORMULA ESCHSCHOLTZI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 513, pl. 45, fig. 10.
Port Simpson to Vancouver Island, British Columbia.

MORMULA TRIDENTATA Carpenter, 1865.
Journ. de Conchyl., vol. 13, p. 147; U. S. Mus., Bull. 68, pl. 11, fig. 12.
Monterey to San Diego, California.

MORMULA AMBUSTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 115, pl. 11, fig. 13.
San Pedro to San Diego, California.

MORMULA SANTOSANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 117, pl. 11, fig. 7.
San Diego ? Todos Santos Bay, Lower California.

MORMULA PENTALOPHA Dall and Bartsch, 1903.
Mem. Cal. Acad. Sci., vol. 3, p. 282, pl. 1, fig. 1.
San Pedro to Todos Santos Bay, Lower California.

MORMULA HETEROLOPHA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 118, pl. 11, fig. 9.
San Diego, California, to San Hipolito Point, Lower California.

MORMULA PERISCELIDA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 119, pl. 11, fig. 6.
Santa Rosa Island, California.

Subgenus BARTSCHELLA Iredale, 1917.

BARTSCHELLA LAMINATA Carpenter, 1856.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 396; U. S. Nat. Mus., Bull. 68, pl. 12, fig. 16.
San Pedro, California, to Point Abreojos, Lower California.

BARTSCHELLA ARATA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 125, pl. 12, fig. 12.
Off Catalina Island, California.

Subgenus DUNKERIA Carpenter, 1856.

DUNKERIA SWANI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 129, pl. 12, fig. 9.
San Pedro, California.

Genus ODOSTOMIA Fleming, 1817.

Subgenus SALASSIELLA Dall and Bartsch, 1909.

SALASSIELLA LAXA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 133, pl. 13, fig. 8.
San Diego, California, to Scammon Lagoon, Lower California.

SALASSIELLA RICHI Dall and Bartsch, 1909.
U. S. Nat, Mus., Bull. 68, p. 133, pl. 13, fig. 6.
San Pedro, California.

Subgenus BESLA Dall and Bartsch, 1904.

BESLA CALLIMORPHA Dall and Bartsch, 1909.
Proc. Cal. Acad. Sci., vol. 3, p. 219; U. S. Nat. Mus., Bull. 68, p. 136, pl. 13, fig. 5.
San Pedro, California.

Subgenus CHRYSALLIDA Carpenter, 1856.

CHRYSALLIDA HETEROCINCTA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 274, pl. 36, fig. 4.
San Diego, California.

CHRYSALLIDA RITTERI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 146, pl. 14, fig. 8.
Catalina Island to San Diego, California.

CHRYSALLIDA EUGENA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 147, pl. 14, fig. 1.
San Pedro, California, to San Hipolito Point, Lower California.

CHRYSALLIDA TRACHIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 148, pl. 15, fig 4.
Monterey to San Diego, California.

CHRYSALLIDA LUCCA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 148, pl. 15, fig. 8.
Monterey to San Diego, California.

CHRYSALLIDA CLEMENTINA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 149, pl. 15, fig. 5.
San Clemente Island, California.

CHRYSALLIDA OLDROYDI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 150, pl. 15, fig. 1.
San Pedro to the Coronado Islands.

CHRYSALLIDA CINCTA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 659; U. S. Nat. Mus., Bull. 68, pl. 15, fig. 2.
Santa Barbara to Pacific beach, California.

CHRYSALLIDA VICOLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 153, pl. 16, fig. 11.
San Pedro, California.

CHRYSALLIDA ASTRICTA Dall and Bartsch, 1907.
Pros. U. S. Nat. Mus., vol. 33, p. 515, pl. 46, fig. 2.
Monterey, California.

CHRYSALLIDA COOPERI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 514, pl. 46, fig. 7.
Monterey, California.

CHRYSALLIDA MONTEREYENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 516, pl. 46, fig. 4.
Monterey to San Luis Obispo, California.

CHRYSALLIDA EUGLYPTA E. Jordan, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 2, pl. 1, fig. 1.
Trinidad, California.

CHRYSALLIDA PULCIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 160, pl. 16, fig. 10.
San Pedro, California.

CHRYSALLIDA VIRGINALIS Dall and Bartsch, 1909.
U. S. Nat. Mus. Bull., 68, p. 160, pl. 18, fig. 7.
San Pedro, California, to Point Abreojos, Lower California.

CHRYSALLIDA OREGONENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 516, pl. 46, fig. 10.
Queen Charlotte Islands, British Columbia, to Monterey, California.

CHRYSALLIDA PROMECES Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 164, pl. 18, fig. 2.
San Diego (?) Todos Santos Bay, Lower California.

CHRYSALLIDA PULCHERRIMA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 164, pl. 17, fig 7.
San Pedro, California.

CHRYSALLIDA VINCTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 165, pl. 17, fig. 4.
San Pedro, California.

CHRYSALLIDA HELGA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 166, pl. 17, fig. 8.
San Pedro, California, to Coronado Islands.

CHRYSALLIDA DICELLA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 274, pl. 36, fig. 4.
San Diego, California.

CHRYSALLIDA THALIA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 275, pl. 36, fig. 3.
Coronado Islands.

CHRYSALLIDA SANCTORUM Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 167, pl. 18, fig. 1.
Todos Santos Bay to San Hipolito Point, Lower California.

CHRYSALLIDA SAPIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 167, pl. 18, fig. 3.
San Diego, California.

Subgenus IVIDELLA Dall and Bartsch, 1909.

IVIDELLA PEDROANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 172, pl. 19, fig. 8.
San Pedro, California, to Scammon Lagoon, Lower California.

IVIDELLA NAVISA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 517, pl. 46, fig. 2.
San Pedro, California, to Scammon Lagoon, Lower California.

IVIDELLA NAVISA DELMONTENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 518, pl. 46, fig. 10.
Off Del Monte, Monterey Bay, California.

Subgenus MIRALDA A. Adams, 1864.

MIRALDA HEMPHILLI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 176, pl. 19, fig. 10.
San Pedro, California, to Point Abreojos, Lower California.

MIRALDA AEPYNOTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 179, pl. 19, fig. 7.
San Pedro, California, to Cape San Lucas.

Subgenus IVARA Dall and Bartsch, 1903.

IVARA TERRICULA Dall and Bartsch, 1903.
Mem. Cal. Acad. Sci., vol. 3, p. 285, pl. 4, fig. 14.
Monterey, California, to Point Abreojos, Lower California.

Subgenus EVALINA Dall and Bartsch, 1904.

EVALINA AMERICANA Dall and Bartsch, 1904.
Proc. Biol. Soc. Wash., vol. 17, p. 16; U. S. Nat. Mus., Bull. 68, pl. 20, fig. 7.
San Pedro, California, to Coronado Islands.

Subgenus IOLAEA A. Adams 1867.

IOLAEA AMIANTA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 519, pl. 46, fig. 9.
Monterey Bay, California, to Point Abreojos, Lower California.

IOLAEA EUCOSMIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 183, pl. 20, fig. 10.
San Pedro, California, to Point Abreojos, Lower California.

Subgenus MENESTHO Moller, 1842.

MENESTHO PHARCIDA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 520, pl. 46, fig. 8.
Queen Charlotte Islands, British Columbia.

MENESTHO EXARA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 521, pl. 46, fig. 6.
Monterey Bay, California.

MENESTHO GLORIOSA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 276, pl. 36, fig. 2.
San Diego, California, to San Hipolito Point, Lower California.

MENESTHO EXCISA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 276, pl. 36, fig. 8.
Catalina Island, California.

MENESTHO AMILDA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 187, pl. 21, fig. 4.
San Diego, California, to Round Island, Lower California.

MENESTHO FARMA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 188, pl. 20, fig. 1.
Catalina Island, California.

MENESTHO ENORA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 189, pl. 21, fig. 2.
San Pedro, California.

MENESTHO FETELLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 189, pl. 21, fig. 9.
San Pedro, California, to San Ignacio Lagoon, Lower California.

MENESTHO HYPOCURTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 190, pl. 21, fig. 8.
Bristol Bay, Bering Sea, in 33 fathoms.

MENESTHO HARFORDENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 521, pl. 46, fig. 5.
Port Harford, California.

Subgenus EVALEA A. Adams, 1860.

EVALEA NUNIVAKENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 194, pl. 22, fig. 6.
North end of Nunivak Island, Bering Sea.

EVALEA KILLISNOOËNSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 195, pl. 22, fig. 7.
Killisnoo, southeastern Alaska.

EVALEA TILLAMOOKENSIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 522, pl. 47, fig. 1.
Off Tillamook, Oregon, in 786 fathoms.

EVALEA ESILDA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 196, pl. 22, fig. 1.
Off San Diego, California, in 359 fathoms.

EVALEA ALEUTICA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 196, pl. 22, fig. 5.
Captains Bay, Unalaska Island, Alaska.

EVALEA KADIAKENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 197, pl. 22, fig. 9.
Kodiak Island, Alaska.

EVALEA YOUNGI Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, N., No. 1143, p. 16, pl. 2, fig. 1.
Barkley Sound, Vancouver Island, British Columbia.

EVALEA THEA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 278, pl. 37, fig. 7; pl. 38, fig. 13.
San Pedro, California.

EVALEA CALLIOPE Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 278, pl. 36, fig. 10.
Off La Jolla, San Diego County, California, in 199 fathoms.

EVALEA CALCARELLA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 279, pl. 37, fig. 4.
Off Santa Rosa Island, California, in 48 fathoms.

EVALEA SPREADBOROUGHI Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, N., No. 1143, p. 17, pl. 2, fig. 2.
Barkley Sound, Vancouver Island, British Columbia.

EVALEA VANCOUVERENSIS Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, N., No. 1143, p. 18, pl. 2, fig. 7.
Barkley Sound, Vancouver Island, British Columbia.

EVALEA QUADRAE Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, N., No. 1143, p. 17, pl. 2, fig. 6.
Barkley Sound, Vancouver Island, British Columbia.

EVALEA CALLIMENE Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 281, pl. 38. fig. 2.
San Pedro, California.

EVALEA CYPRIA Dall and Bartsch, 1910.
Proc U. S. Nat. Mus., vol. 42, p. 282, pl. 37, fig. 9.
Skidegate, Queen Charlotte Islands, British Columbia.

EVALEA EDMONDI E. Jordan, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 3, pl. 1, fig. 2.
Trinidad, California.

EVALEA HYPATIA Dall and Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 282, pl. 37, fig. 5.
Skidegate, Queen Charlotte Islands, British Columbia.

EVALEA BARKLEYENSIS Dall and Bartsch, 1910.
Canada Geol. Surv. Mem., vol. 14, N., No. 1143, p. 19, pl. 2, fig. 8.
Barkley Sound, Vancouver Island, British Columbia.

EVALEA COOKEANA Bartsch, 1912.
Nautilus, vol. 23, p. 138. pl. 11, fig. 7.
Ellamar, Alaska.

EVALEA BALDRIDGAE Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 284, pl. 38, fig. 1.
San Pedro, California.

EVALEA SKIDEGATENSIS Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 284, pl. 38, fig. 7.
Skidegate, Queen Charlotte Islands, British Columbia, to Trinidad, California.

EVALEA CASSANDRA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 285, pl. 38, fig. 5.
Skidegate, Queen Charlotte Islands, British Columbia.

EVALEA WILLETTI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, No. 666, pl. 43, fig. 6.
Prince of Wales Island, Alaska.

EVALEA HERILDA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 197, pl. 23, fig. 8.
San Diego, California.

EVALEA VALDEZI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 526, pl. 48, fig. 2.
Monterey, California.

EVALEA NEMO Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 198, pl. 22, fig. 8.
San Pedro to San Diego, California.

EVALEA IO Dall and Bartsch, 1903.
Mem. Cal. Acad. Sci., vol. 3, p. 281, pl. 1, fig. 14; U. S. Nat. Mus., Bull. 68. p. 199, pl. 22, fig. 4.
Santa Rosa Island to San Pedro and Catalina Island, California.

EVALEA PRATOMA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 199, pl. 23, fig. 4.
Santa Rosa Island, in 50 fathoms.

EVALEA SEPTENTRIONALIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 200, pl. 26, fig. 9.
Unalaska Island, Alaska.

EVALEA CAPITANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 200, pl. 26, fig. 7.
Captains Harbor, Unalaska to Kodiak, Alaska.

EVALEA JEWETTI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 523, pl. 47, fig. 3.
Santa Barbara, California.

EVALEA INFLATA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 524, pl. 47, fig. 8.
Neah Bay, Washington.

EVALEA COLUMBIANA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 525, pl. 47, fig. 9.
Port Rupert, British Columbia, to Puget Sound.

EVALEA UNALASHKENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 203, pl. 26, fig. 5.
Captains Harbor, Unalaska Island, Alaska.

EVALEA ATOSSA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 253; vol. 52, p. 203, pl. 26, fig. 8, 1909.
San Pedro, California.

EVALEA OBESA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 203, pl. 26, fig. 4.
San Pedro, California.

EVALEA FRANCISCANA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 665, pl. 45, fig. 7.
San Francisco Bay, California.

EVALEA PHANEA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 528, pl. 48, fig. 7.
Monterey, California.

EVALEA PHANELLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 205, pl. 23, fig. 9.
San Pedro to San Diego, California.

EVALEA SANTAROSANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 205, pl. 26, fig. 6.
Santa Rosa Island, California.

EVALEA TENUISCULPTA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 659; U. S. Nat. Mus., Bull. 68, pl. 23, fig. 2.
Barkley Sound, Vancouver Island, to Lower California.

EVALEA ANGULARIS Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 523, pl. 47, fig. 2.
Sitka, Alaska, to Port Harford, California.

EVALEA DONILLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 208, pl. 24, fig. 3.
San Pedro, California, to Todos Santos Bay, Lower California.

EVALEA CALIFORNICA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 208, pl. 24, fig. 2.
San Diego, California, to Coronado Islands.

EVALEA SERILLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 209, pl. 24, fig. 9.
Off San Diego, California.

EVALEA TACOMAËNSIS, Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 526, pl. 47, fig. 10.
Tacoma, Puget Sound, Washington.

EVALEA AMCHITKANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 210, pl. 24, fig. 7.
Amchitka Island, Aleutians, to Peril Strait, Alaska.

EVALEA STEPHENSAE Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 210, pl. 24, fig. 5.
Bear Bay, Peril Straits, Alaska, to Barkley Sound, British Columbia.

EVALEA CLESSINI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 211, pl. 24, fig. 4.
Baranoff and Admiralty Islands, Alaska.

EVALEA MINUTISSIMA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 211, pl. 25, fig. 4.
San Diego, California, to Point Abreojos, Lower California.

EVALEA RAYMONDI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 212, pl. 25, fig. 9.
Catalina Island, California.

EVALEA GRAVIDA Gould, 1852.
Proc. Boston Soc. Nat. Hist., vol. 6, p. 376; U. S. Nat. Mus., Bull. 68, p. 212, pl. 25, fig. 7.
Santa Barbara, California.

EVALEA NOTILLA Dall and Bartsch, 1909.
U S. Nat. Mus., Bull. 68, p. 213, pl. 25, fig. 6.
Catalina Island, California.

EVALEA MOVILLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 213, pl. 25, fig. 1.
Off San Diego, California, in 359 fathoms.

EVALEA ALTINA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 214, pl. 25, fig. 2.
Off San Diego, California, in 359 fathoms.

EVALEA PROFUNDICOLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 214, pl. 25, fig. 8.
Point Vincente to San Diego, California, in deep water.

EVALEA BARANOFFENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 215, pl. 25, fig. 3.
Baranoff and Admiralty Islands, Alaska.

EVALEA SITKAËNSIS Clessin, 1900.
Conch. Cab. (Pyramidellidae), ed. 2, p. 121; U. S. Nat. Mus., Bull. 68, pl. 26, fig. 3.
Sitka, Alaska.

EVALEA HAGMEISTERI Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 216, pl. 26, fig. 1.
Hagmeister Island, Bering Sea.

EVALEA RESINA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 216, pl. 27, fig. 6.
Arch Beach, California.

EVALEA DELICIOSA Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 525, pl. 47, fig. 5.
Barkley Sound, Vancouver Island, to Monterey, California.

Subgenus AMAURA Moller, 1842.

AMAURA LASTRA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 219, pl. 28, fig. 7.
Catalina Island to San Diego, California.

AMAURA KENNERLYI Dall and Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 529, pl. 48, fig. 8.
Nanaimo, British Columbia, to Monterey Bay, California.

AMAURA ELSA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 220, pl. 29, fig. 1.
Kodiak Island, Alaska.

AMAURA BERINGI Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 117; U. S. Nat. Mus., Bull. 68, pl. 27, fig. 8.
Norton Sound, Alaska.

AMAURA SUBGLOBOSA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 286, pl. 37, fig. 2.
San Diego, California.

AMAURA SATURA Carpenter, 1865.
Ann. Mag. Nat. Hist. ser. 3, vol. 15, p. 29; U. S. Nat. Mus., Bull. 68, pl 27, fig. 1.
Neah Bay, Washington.

AMAURA ENGBERGI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Juan Islands, Gulf of Georgia.

AMAURA SANJUANENSIS Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Juan Islands, Gulf of Georgia.

AMAURA HELENA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 286, pl. 38, fig. 10.
San Pedro, California.

AMAURA GRIPPIANA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 287, pl. 38, fig. 11.
Nanaimo, British Columbia.

AMAURA FARALLONENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 221, pl. 27, fig. 7.
Off the Farallones Islands, California.

AMAURA SILLANA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 222, pl. 28, fig. 9.
Captains Bay, Unalaska, Alaska.

AMAURA TALPA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 222, pl. 27, fig. 9.
Mole Harbor and Sitka Harbor, Alaska.

AMAURA KRAUSEI Clessin, 1900.
Conch. Cab. (Pyramidellidae), ed. 2, p. 115, pl. 28, fig. 1.
Kodiak to Killisnoo, Alaska.

AMAURA ELDORANA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 287, pl. 38, fig. 12.
Kodiak, Alaska.

AMAURA ORCIA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 223, pl. 27, fig. 3.
Santa Rosa Island, California.

AMAURA GOULDI Carpenter, 1905.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 29; U. S. Nat. Mus., Bull. 68, pl. 27, fig. 2.
Neah Bay, Washington.

AMAURA ARCTICA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 224, pl. 28, fig. 5.
Seahorse Islands, Arctic Ocean, south to Bristol Bay, Bering Sea.

AMAURA AVELLANA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 30; U. S. Nat. Mus., Bull. 68, pl. 28, fig. 3.
Neah Bay, Washington.

AMAURA MORATORA Dall and Bartsch, 1909.
U S. Nat. Mus., Bull. 68, p. 225, pl. 30, fig. 7.
Off Point Reyes, California.

AMAURA PESA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 226, pl. 29, fig. 2.
Kodiak Island, Alaska.

AMAURA NOTA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 226, pl. 28, fig. 6.
Santa Rosa Island, to San Diego, California.

AMAURA ILIULIUKENSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 227, pl. 29, fig. 4.
Unalaska Island, Alaska.

AMAURA NUCIFORMIS Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 30; U. S. Nat. Mus., Bull. 68, pl. 28, fig. 1.
Neah Bay, Washington.

AMAURA WASHINGTONIA Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Juan Islands, Gulf of Georgia.

AMAURA CANFIELDI Dall, 1908.
Nautilus, vol. 31, p. 131; U. S. Nat. Mus., Bull. 68, pl. 28, fig. 2, 1909.
Barkley Sound, British Columbia, to San Diego, California.

AMAURA SUBTURRITA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 228, pl. 28, fig. 4.
Santa Barbara, California, to Todos Santos Bay, Lower California.

AMAURA MARTENSI Dall and Bartsch, 1906.
Proc. U. S. Nat. Mus., vol. 30, p. 361, pl. 15, fig. 5.
Killisnoo, Alaska.

Subgenus HEIDA Dall and Bartsch, 1904.

HEIDA KELSEYI Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 42, p. 288, pl. 38, fig. 6.
San Diego, California.

Subgenus ODOSTOMIA s. s.

ODOSTOMIA FARELLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 232, pl. 30, fig. 4.
Off Long Beach, California.

ODOSTOMIA DINELLA Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull. 68, p. 232, pl. 30, fig. 1.
Off Redondo, California.

ODOSTOMIA CORONADOËNSIS Dall and Bartsch, 1909.
U. S. Nat. Mus., Bull 68, p. 233, pl. 30, fig. 3.
Off Coronado Beach, San Diego, California.

ODOSTOMIA ORCUTTI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 667, pl. 46, fig. 8.
San Diego, California.

Suborder NUCLEOBRANCHIATA.

Family PTEROTRACHEIDAE.

Genus CARDIAPODA Orbigny, 1836.

CARDIAPODA PLACENTA Lesson, 1830.

Voy. de la *Coquille*, Moll., p. 253, No. 3, pl. 3, fig. 2.

North Pacific. Pelagic.

Family CARINARIIDAE.

Genus CARINARIA Lamarck, 1801.

CARINARIA PUNCTATA Orbigny, 1836.

Voy. Amer. Mer., vol. 5, p. 160, pl. 11, figs. 6–15.

North and South Pacific. Pelagic.

CARINARIA LATIDENS Dall, 1919.

Proc. U. S. Nat. Mus., vol. 56, p. 342.

North Pacific in north latitude 43° 10′ and west longitude 147°. Pelagic.

Family ATLANTIDAE.

Genus ATLANTA Lesueur, 1817.

ATLANTA PERONII Lesueur, 1817.

Journ. de Phys., vol. 85, p. 390, pl. 2, figs. 1, 2.

North Pacific in north latitude 33° and west longitude 133°. Pelagic.

ATLANTA INVOLUTA Gray, 1850.

Gray, Figs. Moll. Anim., vol. 4, p. 101; Voy. *Bonite*, Atlas, pl. 21, figs. 9–14 (1841[1]).

Pacific Ocean. Pelagic.

ATLANTA INCLINATA Gray, 1850.

Gray, Figs. Moll. Anim., vol. 4, p. 101; Voy. *Bonite*, Atlas, pl. 19, figs. 8–21.

Pacific Ocean. Pelagic.

ATLANTA HELICINOIDEA Gray, 1850.

Gray, Figs. Moll. Anim., vol. 4, p. 101; Voy. *Bonite*, Atlas, pl. 20, figs. 23–30.

Pacific Ocean. Pelagic.

ATLANTA BRUNNEA Gray, 1850.

Figs. Moll. Anim., vol. 4, p. 101, pl. 242, fig. 5; Voy. *Bonite*, Atlas, pl. 21, figs. 15–29.

Pacific Ocean. Pelagic.

ATLANTA GAUDICHAUDII Gray, 1850.

Figs. Moll. Anim., vol. 4, p. 101, pl. 241, fig. 4; Voy. *Bonite*, Atlas, pl. 20, figs. 29–34.

Pacific Ocean. Pelagic.

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[1] The names in the Atlas of the Voyage of the *Bonite* were in the vernacular only, and were first latinized by Gray, before the appearance of the text of the *Bonite*.

ATLANTA DEPRESSA Gray, 1850.
Figs. Moll. Anim., vol. 4, p. 101; Voy. *Bonite*, Atlas, pl. 20, figs. 31–37.
Pacific Ocean. Pelagic.

ATLANTA QUOYII Gray, 1850.
Figs. Moll. Anim., vol. 4, p. 101, pl. 242, fig. 1; Voy. *Bonite*, Atlas, pl. 20, figs. 16–22.
Pacific Ocean in north latitude 33°, west longitude 135° 10′. Pelagic.

ATLANTA CUNICULA Gould, 1852.
Rep. U. S. Expl. Exp., Moll., p. 492, pl. 51, fig. 598.
North Pacific Ocean. Pelagic.

Genus OXYGYRUS Benson, 1835.

OXYGYRUS RANGI Lovén, 1847.
K. Vetensk. Akad. Forh., p. 491, pl. 4; Voy. *Bonite*, Atlas, pl. 18, figs. 18–24.
Pacific Ocean. Off Monterey, California. Pelagic.

Suborder PECTINIBRANCHIATA.

Superfamily DACTYLOGLOSSA.

Family OVULIDAE.

Genus SIMNIA (Leach) Risso, 1826.

SIMNIA VIDLERI Sowerby, 1881.
Proc. Zool. Soc., p. 638, pl. 56, fig. 1.
Monterey to San Diego, California.

SIMNIA ACICULARIS Lamarck, 1811.
Ann. du Mus. Paris, vol. 16, p. 112.—Tryon, Man., vol. 7, pl. 5, figs. 23–25.
San Pedro to San Diego, California, and Acapulco, Mexico.

SIMNIA VARIABILIS C. B. Adams, 1850.
Panama Shells, p. 255.—Tryon, Man., vol. 7, pl. 5, fig. 44.
Monterey, California, to Panama.

Subgenus Neosimnia Fischer, 1884.

NEOSIMNIA BARBARENSIS Dall, 1892.
Proc. U. S. Nat. Mus., vol. 15, p. 206, pl. 21, fig. 1.
Newport, California, to Gulf of California.

NEOSIMNIA CATALINENSIS Berry, 1916.
Nautilus, vol. 30, No. 2, p. 21, pl. 5, fig. 3.
Monterey to Gulf of California.

NEOSIMNIA UNIPLICATA Sowerby, 1848.
Proc. Zool. Soc., p. 135.—Tryon, Man., vol. 7, pl. 5, fig. 39.
San Pedro, California, to Magdalena Bay, Lower California.

Family PEDICULARIIDAE.

Genus PEDICULARIA Swainson, 1840.

PEDICULARIA CALIFORNICA Newcomb, 1864.
Proc. Cal. Acad. Sci., vol. 3, p. 121; vol. 4, p. 322, pl. 1, fig. 9.
Farallones Islands to Monterey, California.

Superfamily TAENIOGLOSSA.

Family CYPRAEIDAE.

Genus CYPRAEA Linnaeus, 1758.

CYPRAEA SPADICEA Swainson, 1823.
Philos. Mag., vol. 61, p. 376.—TRYON, Man., vol. 7, p. 13, fig. 78.
Santa Barbara, California, to Cerros Island, Lower California.

Family TRIVIIDAE.

Genus TRIVIA Gray, 1832.

TRIVIA RADIANS Lamarck, 1810.
Ann. du Mus. Paris, vol. 15, p. 102.—TRYON, Man., vol. 7, pl. 22, figs. 13, 14.
Santa Barbara and Catalina Island, California, to Ecuador.

TRIVIA SOLANDRI Gray, 1837.
Conch. Ill., *Cypraea*, No. 128, fig. 43.
Catalina Island, California, to Panama.

TRIVIA RITTERI Raymond, 1903.
Nautilus, vol. 17, No. 8, p. 85.
Monterey and San Pedro, California, to Cortez Bank.

TRIVIA SANGUINEA Gray, 1832.
Desc. Cat. *Cypraea*, p. 14.—TRYON, Man., vol. 7, pl. 22, figs. 21, 22.
Catalina Island. Magdalena Bay to Salina Cruz, Mexico. Ecuador?

TRIVIA CALIFORNIANA Gray, 1828.
Zool. Journ., vol. 3, p. 365.—TRYON, Man., vol. 7, pl. 22, figs. 18–20.
Crescent City, California, to West Mexico.

Genus ERATO, Risso, 1826.

ERATO VITELLINA Hinds, 1844.
Zool. Voy. *Sulphur*, Moll., p. 46, pl. 13, figs. 22, 23.
Bodega Bay and Farallones Islands to San Diego, California.

ERATO ALBESCENS Dall, 1905.
Nautilus, vol. 18, No. 11, p. 124.
Off Santa Rosa Island, California, to La Paz, Lower California.

ERATO COLUMBELLA Menke, 1847.
Zeitschr. Mal., vol. 4, p. 183.—TRYON, Man., vol. 5, pl. 4, fig. 48.
Monterey, California, to Panama Bay.

Family RANELLIDAE.

Genus BURSA Bolten, 1798.

Subgenus BUFONARIA Schumacher, 1817.

BUFONARIA CALIFORNICA Hinds, 1843.
Ann. Mag. Nat. Hist., vol. 11, April, p. 255; Zool. Voy. *Sulphur*, Moll., pl. 2, figs. 4, 5.

Monterey, California, to Cerros Island, Lower California.

Family CYMATIIDAE.

Genus ARGOBUCCINUM Mörch, 1852.

Subgenus FUSITRITON Cossmann, 1903.

FUSITRITON OREGONENSIS Redfield, 1848.
Ann. Lyc. Nat. Hist. N. Y., vol. 4, p. 165, pl. 11, fig. 2.
From the line of floating ice in winter in Bering Sea near the Pribilof Islands, south on the west to the Okhotsk Sea and Japan, and on the east to San Nicolas Island, California; San Diego, in deeper water (Raymond).

Genus CYMATIUM Bolten, 1798.

CYMATIUM CORRUGATUM (Lamarck, 1822) TREMPERI Dall, 1907.
Nautilus, vol. 21, No. 8, p. 85.
San Pedro, California, to Gulf of California. Mediterranean?

CYMATIUM GIBBOSUM Broderip, 1833.
Proc. Zool. Soc., p. 7; Conch. Icon., *Triton*, pl. 13, fig. 38.
San Pedro and San Diego, California, to Panama.

Family SEGUENZIIDAE.

Genus SEGUENZIA Jeffreys, 1876.

SEGUENZIA CERTOMA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 343.
Off San Diego, California, in 600 fathoms.

SEGUENZIA GIOVIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 343.
Off Catalina Island, California, in 118 fathoms.

SEGUENZIA CERVOLA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 344.
Off North Coronado Island, in 692 fathoms.

SEGUENZIA CALIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol 56, No. 2295, p. 344.
Off La Jolla and San Diego, California, in 243 to 822 fathoms.

Family TRIFORIDAE.

Genus TRIFORA (Deshayes) Blainville, 1828.

TRIFORA MONTEREYENSIS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 249, pl. 16, fig. 17.
Monterey, California.

TRIFORA PEDROANA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 250, pl. 16, fig. 1.
San Pedro, California, to South Coronado Island.

TRIFORA CALLIPYRGA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 251, pl. 16, fig. 4.
San Pedro to San Diego, California.

TRIFORA CARPENTERI Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 252, pl. 16, fig. 16.
Neah Bay, Washington.

TRIFORA CATALINENSIS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 253, pl. 16, fig. 18.
Catalina Island and Laguna Beach, California.

TRIFORA STEARNSI Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 254, pl. 16, fig. 3.
San Diego, California, to the Gulf of California.

TRIFORA PENINSULARIS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1569, p. 255, pl. 16, fig. 2.
San Diego, California, to Point Abreojos, Lower California.

Family CERITHIOPSIDAE.

Genus CERITHIOPSIS Forbes and Hanley, 1849.

Section CERITHIOPSIS s. s.

CERITHIOPSIS OXYS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 332, pl. 36, fig. 2.
San Pedro, California, to Point Abreojos, Lower California.

CERITHIOPSIS CARPENTERI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 334, pl. 38, fig. 9.
San Pedro, California, to South Coronado Island.

CERITHIOPSIS PEDROANA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 181; vol. 40, pl. 38, fig. 2.
San Pedro, California, to Point Abreojos, Lower California.

CERITHIOPSIS BERRYI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 339, pl. 39, fig. 8.
Monterey Bay, California, to South Coronado Island.

CERITHIOPSIS CESTA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 341, pl. 39, fig. 5.
San Diego, California.

CERITHIOPSIS STEJNEGERI Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 345, pl. 2, fig. 4; vol. 40, p. 342, pl. 40, fig. 3.
Commander, Aleutian, and Shumagin Islands, Alaska.

CERITHIOPSIS STEJNEGERI DINA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 343, pl. 40, fig. 7.
Sitka, Alaska.

CERITHIOPSIS GRIPPI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 56, p 669, pl. 46, fig. 12.
San Diego, California.

CERITHIOPSIS DIOMEDAE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 359, pl. 37, fig. 5.
San Diego, California and Todos Santos Bay.

CERITHIOPSIS PARAMOEA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 356, pl. 38, fig. 4.
Neah Bay, Washington.

CERITHIOPSIS BAKERI Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 56, p. 670, pl. 46, fig. 10.
South Coronado Island, Lower California.

CERITHIOPSIS CHARLOTTENSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 56, p. 668, pl. 46, figs. 9, 11.
Queen Charlotte Islands, British Columbia, to Puget Sound.

CERITHIOPSIS MONTEREYENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 363, pl. 41, fig. 5.
Little River, Mendocino County, to Monterey, California.

Section CERITHIOPSIDA Bartsch, 1911.

CERITHIOPSIS DIEGENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 347, pl. 40, fig. 4.
San Pedro to San Clemente Island, California, and South Coronado Island.

CERITHIOPSIS ROWELLI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 348, pl. 40, fig. 6.
California.

CERITHIOPSIS GLORIOSA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p 353, pl 36, fig. 7.
Off San Diego, California, in 15 fathoms.

CERITHIOPSIS ANTEMUNDA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 359, pl. 36, fig. 4.
San Pedro to San Diego, California.

Section CERITHIOPSIDELLA Bartsch, 1911.

CERITHIOPSIS COSMIA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 180; vol. 40, pl. 38, fig. 7.
Monterey, California, to San Bartolome Bay, Lower California.

CERITHIOPSIS ANTEFILOSA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 349, pl. 40, fig. 9.
San Pedro to San Diego, California.

CERITHIOPSIS ALCIMA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 350, pl. 39, fig. 2.
San Pedro, California, to South Coronado Island.

INCERTAE SEDIS.

CERITHIOPSIS COLUMNA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 660; Proc. U. S. Nat. Mus., vol. 40, p. 354, pl. 36, fig. 6.
Vancouver Island to Monterey Bay.

CERITHIOPSIS ARNOLDI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 357, pl. 39, fig. 3.
San Pedro Bay, California.

CERITHIOPSIS TRUNCATA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 304, pl. 4, fig. 5; vol. 40, pl. 40, fig. 2.
Unalaska Island, Alaska, to Puget Sound.

CERITHIOPSIS STEPHENSAE Bartsch, 1909.
Proc. U. S. Nat. Mus., vol. 37, p. 399, fig.; vol. 40, pl. 38, fig. 7.
Port Frederick, Alaska, to Puget Sound.

CERITHIOPSIS INGENS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 180; vol. 40, pl. 41, fig. 4.
Monterey, California.

CERITHIOPSIS TUMIDA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, p. 179; vol. 40, pl. 41, fig. 3.
Monterey, California.

Genus SEILA A. Adams, 1861.

SEILA MONTEREYENSIS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 177; vol. 40, pl. 41, fig. 5.
Monterey to Todos Santos Bay, Lower California.

Genus METAXIA Monterosato, 1884.

METAXIA DIADEMA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 182.
Monterey to San Diego, California.

Family CERITHIIDAE.

Genus DIASTOMA Deshayes, 1861.

DIASTOMA FASTIGIATA Carpenter, 1864.
Suppl. Rep. Brit. Soc., p. 655; Proc. U. S. Nat. Mus., vol. 39, p. 581, fig. 1, 1911.
Santa Barbara, California. Pleistocene.

DIASTOMA OLDROYDAE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 583, fig. 3.
San Pedro, California.

DIASTOMA STEARNSI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 584, fig. 4.
San Diego, California.

Genus ALABINA Dall, 1902.

ALABINA CALIFORNICA Dall and Bartsch, 1901.
Nautilus, vol. 15, p. 58; Proc. U. S. Nat. Mus., vol. 39, p. 414, pl. 62, fig. 7.
San Pedro, California. Pleistocene.

ALABINA BARBARENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 411, pl. 61, fig. 3.
Santa Barbara, California. Pleistocene.

ALABINA HAMLINI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 411, pl. 61, fig. 2.
Los Angeles, California. Pleistocene.

ALABINA PHANEA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 412, pl. 62, fig. 6.
San Diego, California.

ALABINA IO Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 415, pl. 61, fig. 1.
Signal Hill, Long Beach, California. Pleistocene.

ALABINA TENUISCULPTA Carpenter, 1864.
Suppl. Rep. Brit Assoc., pp. 612, 655; Proc. U. S. Nat. Mus., vol. 39, p. 415, pl. 61, fig. 6.
San Pedro, California, to Magdalena Bay.

ALABINA TENUISCULPTA PHALACRA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 417, pl. 61, fig. 5.
San Diego, California.

ALABINA DIEGENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 416, pl. 61, fig. 4.
San Pedro, California, to San Bartolome Bay, Lower California.

ALABINA? CALENA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 345.
Off San Luis Obispo Bay, California, in 252 fathoms.

Genus BITTIUM (Leach) Gray, 1847.

Subgenus BITTIUM s. s.

BITTIUM JOHNSTONAE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 387, pl. 53, fig. 6.
Laguna Beach, California, to Lower California.

Subgenus STYLIDIUM Dall, 1907.

STYLIDIUM ESCHRICHTII Middendorff, 1849.
Beitr. Mal. Rossica., vol. 2, p. 68, pl. 11, fig. 1.
Sitka, Alaska, to Puget Sound.

STYLIDIUM ESCHRICHTII ICELUM Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 178; vol. 40, pl. 57, fig. 3.
Fuca Strait to Monterey, California.

STYLIDIUM ESCHRICHTII MONTEREYENSE Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 178; vol. 40, p. 58, fig. 5.
Crescent City, California, to Cape San Lucas. Also Pliocene.

STYLIDIUM PAGANICUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 345.
Off Monterey Bay, California, in 356 fathoms.

Subgenus SEMIBITTIUM Cossmann, 1896.

SEMIBITTIUM VANCOUVERENSE Dall and Bartsch, 1910.
Canada Geol. Survey Mem., vol. 14 N, p. 10, pl. 1, fig. 8.
Barkley Sound, Vancouver Island.

SEMIBITTIUM ATTENUATUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 655; Proc. U. S. Nat. Mus., vol. 40, p. 393, pl. 54, figs. 1, 2, 5.
Forrester Island, Alaska, to San Diego.

SEMIBITTIUM ATTENUATUM BOREALE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 395, pl. 54, fig. 4.
Queen Charlotte Islands to Vancouver Island.

SEMIBITTIUM ATTENUATUM MULTIFILOSUM Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 40, p. 395, pl. 54, fig. 3.
Monterey to San Pedro, California.

SEMIBITTIUM ATTENUATUM LATIFILOSUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 395, pl. 54, fig. 6.
San Pedro, California.

SEMIBITTIUM SUBPLANATUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 395, pl. 57, fig. 5.
Monterey Bay to South Coronado Island.

SEMIBITTIUM RUGATUM Carpenter, 1866.
Ann. Mag. Nat. Hist., ser. 3, vol. 18, p. 276; Proc. U. S. Nat. Mus., vol. 40, p. 397, pl. 56, figs. 4, 5.
San Pedro and Catalina Island. Santa Barbara Pleistocene.

SEMIBITTIUM QUADRIFILATUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 655; Proc. U. S. Nat. Mus., vol. 40, p. 398, pl. 58, figs. 2, 3, 1911.
Monterey, California, to San Ignacio Lagoon, Lower California.

? SEMIBITTIUM ARMILLATUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 655; Proc. U. S. Nat. Mus., vol. 40, p. 391, pl. 52, fig. 6.
Santa Barbara and San Pedro, California. Pleistocene.

? SEMIBITTIUM PURPUREUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 660; Proc. U. S. Nat. Mus., vol. 40, pl. 52, figs. 1, 3.
Monterey to San Diego, California.

? SEMIBITTIUM CHALLISAE Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 673, pl. 47, figs. 2, 6.
San Juan Island, Gulf of Georgia.

? SEMIBITTIUM SANJUANENSE Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 674, pl. 47, fig. 4.
San Juan Island, Gulf of Georgia.

? SEMIBITTIUM SERRA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 675, pl. 47, fig. 1.
Off Point Pinos to San Diego, California, in 75 fathoms, and San Bartolome Bay, Lower California.

Subgenus Lirobittium Bartsch, 1911.

LIROBITTIUM INTERFOSSA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Proc. U. S. Nat. Mus., vol 40, p. 401, pl. 51, figs. 2, 6.
Monterey to San Diego, California.

LIROBITTIUM CATALINENSE Bartsch, 1907.
Smithsonian Misc. Coll., vol. 50, p. 28, pl. 57, fig. 13.
Catalina Island to San Diego. Santa Barbara Pleistocene.

LIROBITTIUM CATALINENSE INORNATUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 403, pl. 51, fig. 3.
Catalina Island to San Diego. Also Pleistocene.

LIROBITTIUM ORNATISSIMUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 403, pl. 52, figs. 4, 5.
San Pedro, California. Santa Barbara Pleistocene.

LIROBITTIUM MUNITUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., pp. 628, 660; Proc. U. S. Nat. Mus., vol 40, pl. 53, figs. 1, 2.
Sitka Sound to Fuca Strait.

LIROBITTIUM MUNITUM MUNITOIDE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 405, pl. 53, fig. 4.
San Pedro, California.

LIROBITTIUM ASPERUM Gabb, 1861.
Proc. Acad. Nat. Sci. Phila., p. 368; Proc. U. S. Nat. Mus., vol. 40, p. 405, pl. 56, fig. 3.
Pleistocene: Santa Barbara to San Diego. Also Pliocene.

LIROBITTIUM ASPERUM LOMAËNSE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 406, pl. 56, fig. 2.
Catalina Island to San Diego, California.

LIROBITTIUM LARUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 407, pl. 57, fig. 4.
San Pedro, California, to San Bartolome Bay, Lower California.

INSERTAE SEDIS.

BITTIUM OLDROYDI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 408, pl. 51, fig. 5.
Destruction Island, Washington, to Lower California.

BITTIUM FETELLUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 409, pl. 51, fig. 4.
Off Catalina Island in 16 fathoms.

BITTIUM GIGANTEUM Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 40, p. 410, pl. 55, fig. 2.
Pleistocene of San Pedro and San Diego, California.

Genus POTAMIDES Brongniart, 1810.

Subgenus Pirenella Gray, 1847.

PIRENELLA CYCLUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 346.
Long Beach, California, to Gulf of California.

Subgenus Liocerithium Tryon, 1887.

LIOCERITHIUM SCULPTUM Sowerby, 1855.
Thes. Conch., vol. 2, p. 868, figs. 144, 145.
Santa Barbara Islands, California, to Panama and the Galapagos Islands.

Genus CERITHIDEA Swainson, 1840.

CERITHIDEA CALIFORNICA Haldeman, 1840.
Mon. Freshwater Shells, N. Amer., cover of No. 1.—Tryon, Man., vol. 9, pl. 33, figs. 69, 70, 71.
Baulinas Bay to San Diego, California.

Family TRICHOTROPIDAE.

Genus TRICHOTROPIS Sowerby, 1829.

TRICHOTROPIS BICARINATA Sowerby, 1825.
Tankerville Catalogue, pp. 55, XII, pl. 9.
Arctic Ocean from Point Barrow south, on the west to the Okhotsk Sea and Shantar Islands, and on the east to Nunivak Island, Bering Sea.

TRICHOTROPIS CONICA Moller, 1842.
Index Moll. Grönl., p. 82.—Tryon, Man., vol. 9, pl. 7, fig. 45.
Forrester Island, Alaska; also Greenland.

TRICHOTROPIS COSTELLATA Couthouy, 1838.
Boston Journ. Nat. Hist., vol. 2, p. 108, pl. 3, fig. 2.
Arctic Seas, Bering Sea, the Aleutian Islands and south to the Queen Charlotte Islands, British Columbia; also New England coast.

TRICHOTROPIS CANCELLATA Hinds, 1843.
Proc. Zool. Soc., p. 17; Zool. Voy. *Sulphur*, Moll., pl. 11, figs. 11, 12.
Southern part of Bering Sea, and south to Oregon.

TRICHOTROPIS INSIGNIS Middendorff, 1849.
Beitr. Mal. Rossica, p. 107, pl. 10, fig. 7–9.
From Bering Strait south, on the west to Northern Japan, and on the east to the Aleutian Islands and Cooks Inlet, Alaska.

Subgenus IPHINOË H. and A. Adams, 1854.

IPHINOË CORONATA Gould, 1860. (Plate 11, fig. 2.)
Proc. Boston Soc. Nat. Hist., vol. 7, p. 324.—TRYON, Man., vol. 7, pl. 7, figs. 53, 54.
Arctic Ocean and Bering Sea.

IPHINOË KROYERI Philippi, 1849. (Plate 11, fig. 1.)
Zeitschr. f. Mal., vol. 5, p. 175.—TRYON, Man., vol. 7, pl. 8, fig. 61.
Arctic and Bering Seas, eastward to the Shumagin Islands.

IPHINOË KELSEYI Dall, 1905.
Proc. U. S. Nat. Mus., vol. 34, No. 1610, p. 254.
Off San Diego, Cal., and Point San Quentin, Lower California.

Subgenus PROVANNA Dall, 1918.

PROVANNA LOMANA Dall, 1918.
Proc. Biol. Soc. Wash., vol. 31, p. 7.
Off Point Loma, San Diego County, California, in 650 fathoms.

Family CAECIDAE.

Genus CAECUM Fleming, 1817.

CAECUM CALIFORNICUM Dall, 1885.
Proc. U. S. Nat. Mus., vol. 8, p. 541.—TRYON, Man., vol. 8, pl. 66, fig. 65.
Monterey, California, to Lower California.

CAECUM DALLI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Pedro, California, to Lower California.

CAECUM LICALUM Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Monterey to San Diego, California.

CAECUM DIEGENSE Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Diego, California.

CAECUM GRIPPI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Off San Diego, 15 to 20 fathoms.

Genus MICRANELLUM Bartsch, 1920.

MICRANELLUM CREBRICINCTUM Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 3, p. 215.—TRYON, Man., vol. 8, pl. 67, figs. 71, 88.
Monterey, California, to Todos Santos Bay, Lower California.

MICRANELLUM PEDROËNSE Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Pedro to San Diego, California.

MICRANELLUM CATALINENSE Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Santa Rosa and Santa Catalina Islands, California.

MICRANELLUM PROFUNDICOLUM Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Off San Diego, 55 to 199 fathoms.

MICRANELLUM OREGONENSE Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Forrester Island, Alaska, to Monterey, California.

MICRANELLUM BARKLEYENSE Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Barkley Sound, Vancouver Island.

MICRANELLUM ROSANUM Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Off Santa Rosa Island, California, in 48 fathoms.

Genus FARTULUM Carpenter, 1858.

FARTULUM ORCUTTI Dall, 1885.
Proc. U. S. Nat. Mus., vol. 8, p. 541.
San Pedro to Mazatlan, Mexico.

FARTULUM HEMPHILLI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Pedro, California, to Point Abreojos, Lower California.

FARTULUM OCCIDENTALE Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Gulf of Georgia to Lower California.

FARTULUM BAKERI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Ellamar, Alaska, to Mazatlan, Mexico.

Genus ELEPHANTULUM Carpenter, 1858.

ELEPHANTULUM CARPENTERI Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
San Pedro, California, to Point Abreojos, Lower California.

Family VERMETIDAE.

Genus BIVONIA Gray, 1850.

BIVONIA COMPACTA Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 427.
Vancouver Island to San Pedro, California (Peru, Cooper).

Genus VERMICULARIA Lamarck, 1799.

VERMICULARIA EBURNEA Reeve, 1842.
Conch. Syst., vol. 2, p. 46, pl. 152, fig. 2.
San Pedro, California, to Panama.

Genus ALETES Carpenter, 1857.

ALETES SQUAMIGERUS Carpenter, 1856.
Proc. Zool. Soc., p. 226.—Tryon, Man., pl. 54, figs. 73, 74.
Monterey, California, to Payta, Peru, and the Galapagos Islands.

ALETES CENTIQUADRUS Valenciennes, 1846.
Voy. *Venus*, Atlas, pl. 11, fig. 1*a*.
San Diego, California, to Panama.

Genus VERMICULUM Montagu, 1803.

VERMICULUM ANELLUM Mörch, 1861.
Proc. Zool. Soc., p. 359.—Tryon, Man., vol. 8, pl. 49, fig. 34.
Monterey, California, to Todos Santos Bay, Lower California.

Genus SPIROGLYPHUS Daudin, 1800.

SPIROGLYPHUS LITUELLUS Mörch, 1861.
Proc. Zool. Soc., p. 154.—Tryon, Man., vol. 8, pl. 54, fig. 82.
Forrester Island, Alaska, to San Diego, California.

Genus PETALOCONCHUS Lea, 1843.

PETALOCONCHUS MACROPHRAGMA Carpenter, 1857.
Mazatlan Cat., p. 309.—Tryon, Man., vol. 8, pl. 48, fig. 16.
San Diego, California, to Panama.

PETALOCONCHUS MONTEREYENSIS Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 250.
Monterey, California.

PETALOCONCHUS COMPLICATUS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, p. 326.
Puget Sound to Panama.

Genus THYLACODES Guettard, 1774.

THYLACODES ERUCIFORMIS Mörch, 1861.
Proc. Zool. Soc., p. 70.
"California" (Mörch).

Family TURRITELLIDAE.

Genus TURRITELLA Lamarck, 1799.

TURRITELLA NODULOSA King, 1831.
Zool. Journ., vol. 5, p. 347.—Tryon, Man., vol. 8, pl. 63, figs. 78, 79.
San Diego, California, to Panama.

TURRITELLA MARIANA Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 327, pl. 11, fig. 14.
Catalina Island, California, to Panama Bay.

TURRITELLA JEWETTI Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 655; Ann. Mag. Nat. Hist., ser. 3, vol. 17, p. 276.
Santa Barbara, California, to Salina Cruz, Mexico. Also Pleistocene.

TURRITELLA COOPERI Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 216.—Tryon, Man., vol. 8, p. 200, pl. 61, fig. 61.
Monterey to San Diego, California.

Genus TURRITELLOPSIS G. O. Sars, 1878.

TURRITELLOPSIS ACICULA STIMPSONI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 347.—Sars, Moll. Reg. Arct. Norv., pl. 10, fig. 14.
Nunivak Island, Alaska, to San Diego, California. Circumboreal.

Genus TACHYRHYNCHUS Mörch, 1868.

TACHYRHYNCHUS EROSUS Couthouy, 1838.
Boston Journ. Nat. Hist., vol 2, p. 103, pl. 3, fig. 1.
Arctic Ocean, south on the west to the Kuril Islands, and on the east to the Aleutian Islands and Kodiak, Alaska. Also Greenland.

TACHYRHYNCHUS EROSUS MAJOR Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 346.
Mouth of the Colville River, Arctic Alaska and south through the eastern part of Bering Sea to the Pribilof and Unimak Islands.

TACHYRHYNCHUS RETICULATUS Mighels, 1842.
Boston Journ. Nat. Hist., vol. 4, p. 50, pl. 4, fig. 19.
Arctic Ocean and eastern Bering Sea to the Aleutian Islands and southward to British Columbia. Also Greenland.

TACHYRHYNCHUS LACTEOLUS Carpenter, 1865. (Plate 6, fig. 2.)
Proc. Acad. Nat. Sci. Phila., p. 62.
Chignik Bay, Alaska Peninsula, east and south to Point Abreojos, Lower California.

TACHYRHYNCHUS LACTEOLUS SUBPLANATUS Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 62.
Puget Sound to San Diego, California.

? TACHYRHYNCHUS PRATOMUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 347.
Semidi Islands, Alaska, in 20 fathoms, to Lower California.

? TACHYRHYNCHUS STEARNSII Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 347.
San Pedro, California.

Family LITTORINIDAE.

Genus LITTORINA Ferussac, 1822.

Section LITTORINA s. s.

LITTORINA PALLIATA Say, 1822.
Journ. Acad. Nat. Sci. Phila., vol. 2, p. 240; Gould, Inv. Mass., p. 261, fig. 177.
Atlantic. Pliocene of Nome, Alaska, (not known living on the Pacific side).

Section ALGARODA Dall, 1918.

LITTORINA SQUALIDA Broderip and Sowerby, 1829.

Zool. Journ., vol. 4, p. 370; Zool. Beechey's Voy., p. 139, pl. 34, fig. 12.—Middendorff, Beitr. Mal. Rossica, vol. 2, p. 57; Sibirische Reise, pl. 11, figs. 4–10.

Cape York, Arctic Ocean, to Pribilof Islands and the Okhotsk Sea.

Section LITTORIVAGA Dall, 1918.

LITTORINA SITCHANA Philippi, 1845.

Proc. Zool. Soc., p. 140.—Tryon, Man., vol. 9, p. 240, pl. 41, fig. 90.

Southern Bering Sea, both coasts, and southward on the east to Puget Sound.

LITTORINA ATKANA Dall, 1886.

Proc. U. S. Nat. Mus., vol. 9, p. 211; vol. 24, pl. 39, fig. 11.

Kyska Island, Alaska, and eastward to Cook's Inlet.

LITTORINA ALEUTICA Dall, 1872.

Proc. Cal. Acad. Sci., vol. 4, p. 271, pl. 1, fig. 3; Proc. U. S. Nat. Mus., vol. 24, pl. 39, figs. 4, 6.

Pribilof Islands and the Aleutians from Kyska eastward to the Chika Islands, on isolated islets.

LITTORINA GRÖNLANDICA Menke, 1830.

Synopsis, p. 45.—Tryon, Man., vol. 9, pl. 41, fig. 7.

The Okhotsk and Bering seacoasts and eastward to Sitka, Alaska; Puget Sound? Also Greenland.

LITORINA RUDIS Donovan, 1800.

British Shells, vol. 1, pl. 33, fig. 3.

Aleutian Islands to Puget Sound. Also Atlantic.

LITORINA PLANAXIS Philippi, 1847.

Abb. u. Beschr., *Littorina*, pl. 4, fig. 16.

From Puget Sound south to Magdalena Bay, Guadelupe and Socorro Islands.

Subgenus MELARHAPHE (Mühlfeldt) Menke, 1828.

MELARHAPHE SCUTULATA Gould, 1849.

Proc. Boston Soc., Nat. Hist., vol. 3, p. 83.—Tryon, Man., vol. 9, pl. 45, figs. 98–100; 1–3.

Kodiak Island, Alaska, south to Turtle Bay, Lower California, and Socorro Island.

Subgenus ALGAMORDA Dall, 1918.

ALGAMORDA NEWCOMBIANA Hemphill, 1876. (Plate 5, fig. 5.)

Proc. Cal. Acad. Sci., vol. 7, p. 49; Cat. N. Amer. Shells, p. 6, No. 537.

Humboldt Bay, California.

? ALGAMORDA SUBROTUNDATA Carpenter, 1865.

Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 28.

Neah Bay, Washington.

? ALGAMORDA CASTANEA Carpenter, 1865.

Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 28.

Neah Bay, Washington.

Family LACUNIDAE.

Genus LACUNA Turton, 1827.

LACUNA PORRECTA Carpenter, 1864. (Plate 14, fig. 2.)
Suppl. Rep. Brit. Assoc., p. 656; Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 428.—Tryon, Man., vol. 9, p. 265, pl. 50, fig. 55.
Commander Islands, Bering Sea, southward and eastward to San Diego, California.

LACUNA PORRECTA EFFUSA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 428.—Tryon, Man., vol. 9, pl. 50, fig. 56.
Fuca Strait to San Francisco, California.

LACUNA PORRECTA EXAEQUATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 428.—Tryon, Man., vol. 9, pl. 50, fig. 57.
Neah Bay, Washington.

LACUNA PORRECTA PUTEOLOIDES (Carpenter MS.) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 349.
Lobitas, California.

LACUNA GLACIALIS Moller, 1842.
Index Moll. Grönl., p. 9.—Tryon, Man., vol. 9, pl. 50, fig. 76.
St. Paul Island, Pribilof group. Also Greenland.

LACUNA DIVARICATA Fabricius, 1780.
Fauna Grönlandica, p. 392.—Tryon, Man., vol. 9, pl. 50, fig. 75.
Norton Sound, Alaska, and south to Santa Barbara, California, also Pliocene. Also Northern Europe and Greenland.

LACUNA SOLIDULA Lovén, 1846.
Index Moll. Scand., p. 23.—Tryon, Man., vol. 9, pl. 50, fig. 69.
Puget Sound, Washington, to San Diego, California. Also Atlantic.

LACUNA VARIEGATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656.—Tryon, Man., vol. 9, pl. 50, fig. 64 ?
Neah Bay, Washington, to Monterey, California.

LACUNA UNIFASCIATA Carpenter, 1856.
Proc. Zool. Soc., p. 205.—Tryon, Man., vol. 9, pl. 50, fig. 74.
Santa Barbara, California, to Magdalena Bay, Lower California.

LACUNA UNIFASCIATA AURANTIACA Carpenter, 1856.
Proc. Zool. Soc., p. 205.
Santa Barbara, California, to Point Abreojos, Lower California.

LACUNA MARMORATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 348.—Tryon, Man., vol. 9, pl. 50, fig. 58.
Saginaw Bay, Alaska, to San Diego, California.

Subgenus Boetica Dall, 1918.

BOETICA VAGINATA Dall, 1918.
Proc. Biol. Soc. Wash., vol. 21, p. 137; Proc. U. S. Nat. Mus., vol. 56, p. 349.
Santa Rosa Island, in 53 fathoms, and off La Jolla, San Diego, County, California, 199 fathoms.

Genus HALOCONCHA Dall, 1886.

HALOCONCHA REFLEXA Dall, 1884.
Proc. U. S. Nat. Mus., vol. 7, p. 344, pl. 2, figs. 1–3.
Pribilof Islands

HALOCONCHA MINOR Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 350.
Commander, Pribilof and Aleutian Islands eastward to Chirikoff Island, Alaska.

Genus AQUILONARIA Dall, 1886.

AQUILONARIA TURNERI Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 204, pl. 3, figs. 1–3.
Arctic Ocean near Bering Strait. Also Labrador.

Family FOSSARIDAE.

Genus FOSSARUS Philippi, 1840.

FOSSARUS PARCIPICTUS Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 476.
Todos Santos Bay, Lower California, to Panama.

FOSSARUS ANGIOLUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 350.
Todos Santos Bay near San Diego, California.

Genus ISELICA Dall, 1918.

ISELICA FENESTRATA Carpenter, 1864. (Plate 13, fig. 2.)
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 429.—TRYON, Man., vol. 9, p. 272, pl. 52, fig. 11.
Puget Sound to the Gulf of California.

ISELICA OBTUSA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Proc. Cal. Acad. Sci., vol. 3, p. 217.
Monterey to San Diego, California.

ISELICA OBTUSA LAXA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 251.
Vancouver Island and Puget Sound.

Family LITIOPIDAE.

Genus LITIOPA Rang, 1829.

LITIOPA BOMBYX Rang, 1829.
Ann. Sci. Nat., p. 203.—TRYON, Man., vol. 9, pl. 53, fig. 74.
Southern California and Gulf of California. Pelagic.

Genus ALABA A. Adams, 1862.

ALABA JEANETTAE Bartsch, 1910.
Proc. U. S. Nat. Mus., vol. 39, p. 155, figs. 3, 4.
San Pedro, California, to Gulf of California.

ALABA CATALINENSIS Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Catalina Island, California.

Family?

Genus DIALA A. Adams, 1861.

DIALA MARMOREA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 657; Proc. Cal. Acad. Sci., vol. 3, p. 218.—Tryon, Man., vol. 9, pl. 53, fig. 87.
Queen Charlotte Islands, British Columbia, to San Pedro, California.

DIALA ACUTA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 657; Proc. Cal. Acad. Sci., vol. 3, p. 218.—Tryon, Man., vol. 9, pl. 53, fig. 86 ?
Monterey, California, to Coronado Islands.

DIALA EXILIS Tryon, 1866.
Amer. Journ. Conch., vol. 2, p. 12, pl. 2, fig. 18.
San Francisco Bay to San Diego, California.

Genus BARLEEIA Clark, 1855.

BARLEEIA HALIOTIPHILA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Journ. de Conchyl., vol. 12, p. 144.—[redacted] Man., vol. 9, pl. 60, fig. 74.
Mendocino County, California, to Lower California.

BARLEEIA SANJUANENSIS Bartsch, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 170, pl. 13, fig. 3.
San Juan Islands, Gulf of Georgia.

BARLEEIA SUBTENUIS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Proc. Cal. Acad. Sci., vol. 3, p. 218.—Tryon, Man., vol. 9, pl. 60, fig. 73.
San Pedro, California, to San Ignacio Lagoon, Lower California.

BARLEEIA SUBTENUIS RIMATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 656; Journ. de Conchyl., vol. 12, p. 144.
San Diego, California.

BARLEEIA CORONADOËNSIS Bartsch, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 175, pl. 13, fig. 5.
Off Coronado Island in 7 to 10 fathoms.

BARLEEIA DALLI Bartsch, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 168, pl. 13, fig. 10.
Off Point Loma, California, in 75 fathoms.

BARLEEIA BENTLEYI Bartsch, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 168, pl. 13, fig. 2.
Venice, California.

BARLEEIA OLDROYDI Bartsch, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 171, pl. 13, fig. 9.
Mink Bay, Vancouver Island, to Coronado Islands.

BARLEEIA CALIFORNICA Bartsch, 1920.
Proc. U. S. Nat. Mus., vol. 58, p. 173, pl. 13, fig. 7.
San Pedro, California, to Point Abreojos, Lower California.

Family RISSOIDAE.

Genus CINGULA Fleming, 1828.

CINGULA MARTYNI Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 306, pl. 3, fig. 9.
Bering Strait to the Aleutians and eastward to Chignik Bay, Alaska.

CINGULA MARTYNI SCIPIO Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 306, pl. 4, fig. 10.
Pribilof Islands to the Aleutians and eastward to Middleton Island, Alaska.

CINGULA ALASKANA Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 41, p. 486, pl. 41, fig. 4.
Amchitka Island, Aleutians.

CINGULA ALEUTICA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 307, pl. 3, fig. 11.
Pribilof Islands to the Aleutians and eastward to Windfall Harbor, Admiralty Island, Alaska.

CINGULA KATHERINAE Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 41, p. 488, pl. 41, fig. 3.
Windfall Harbor, Admiralty Island, Alaska.

CINGULA MONTEREYENSIS Bartsch, 1912.
Proc. U. S. Nat. Mus., vol. 41, p. 488, pl. 41, fig. 1.
Monterey, California.

? CINGULA CALIFORNICA Tryon, 1865.
Amer. Journ. Conch., vol. 1, p. 221, pl. 22, fig. 11.
San Francisco Bay to San Pedro, California.

? CINGULA ORVIETA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 351.
San Diego, California.

Subgenus NODULUS Monterosato, 1878.

NODULUS CERINELLUS Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 307, pl. 4, fig. 12.—BARTSCH, Proc. U. S. Nat. Mus., vol. 61, p. 289, fig. 1.
Kyska and Amchitka Islands, Alaska.

NODULUS ASSER Bartsch, 1910.
Nautilus, vol. 23, No. 11, p. 138, pl. 11, fig. 9.
Atka Island, Aleutians, to Cook's Inlet.

NODULUS KELSEYI Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 290, fig. 3.
San Diego, California, and the South Coronado Island.

NODULUS KYSKENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 291, fig. 4.
Kyska and Atka Islands, Aleutians.

NODULUS PALMERI Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 251.
Pribilof Islands, Bering Sea.

Genus SKENEOPSIS Iredale, 1915.

SKENEOPSIS ALASKANA Dall, 1919.
Proc. Biol. Soc. Wash., vol. 32, p. 251.
Pribilof and Unalaska Islands, Alaska.

Genus AMPHITHALAMUS Carpenter, 1865.

AMPHITHALAMUS INCLUSUS Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 181; Proc. U. S. Nat. Mus., vol. 41, p. 264, fig. 2.
Catalina Island to San Diego, California.

AMPHITHALAMUS LACUNATUS Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 218; Proc. U. S. Nat. Mus., vol. 41, p. 263, fig. 1.
San Pedro, California.

AMPHITHALAMUS TENUIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 264, fig. 3.
Monterey to San Diego, California.

Genus ALVANIA (Leach) Risso, 1826.

ALVANIA CASTANELLA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 307, pl. 3, fig. 5.
Kyska to Atka Island, Aleutians.

ALVANIA AURIVILLII Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 308, pl. 4, fig. 8.
Kyska to Adakh Island, Aleutians.

ALVANIA BAKERI Bartsch, 1910.
Nautilus, vol. 23, No. 11, p. 137, pl. 11, fig. 8.
Port Graham, Cook's Inlet, Alaska.

ALVANIA TRACHISMA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 339, pl. 29, fig. 7.
Monterey, California.

ALVANIA CALIFORNICA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 340, pl. 29, fig. 9.
Monterey, California.

ALVANIA CARPENTERI Weinkauff, 1885.
Conch. Cab., ed. 2 p. 192; Proc. U. S. Nat. Mus., vol. 41, pl. 29, fig. 8.
Forrester Island, Alaska, to Neah Bay, Washington.

ALVANIA PEDROANA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 341, pl. 29, fig. 4.
San Pedro, California. Pleistocene.

ALVANIA FILOSA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 28; Proc. U. S. Nat. Mus., vol. 41, pl. 30, fig. 7.
Neah Bay, Washington.

ALVANIA ALASKANA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 307, pl. 4, fig. 9.
Nunivak Island, Bering Sea.

ALVANIA SANJUANENSIS Bartsch, 1920.
Proc. U. S. Nat. Mus.
San Juan Islands, Gulf of Georgia.

ALVANIA MONTEREYENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 343, pl. 30, fig. 2.
Sitka, Alaska, to Monterey, California.

ALVANIA ROSANA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 349, pl. 31, fig. 6.
Santa Rosa and Santa Catalina Islands, California.

ALVANIA ILIULIUKENSIS Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 350, pl. 31, fig. 2.
Iliuliuk Harbor, Unalaska, to Belkoffski, Alaska.

ALVANIA COMPACTA Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 62; Proc. U. S. Nat. Mus., vol. 41, p. 351, pl. 31, fig. 7.
Port Etches, Alaska, to Trinidad, California.

ALVANIA ACUTILIRATA Carpenter, 1866.
Proc. Cal. Acad. Sci., vol. 3, p. 217; Proc. U. S. Nat. Mus., vol. 41, pl. 31, fig. 3.
San Diego, California.

ALVANIA DINORA Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 678, pl. 46, fig. 5.
Forrester Island, Alaska.

ALVANIA KYSKAËNSIS Bartsch, 1917.
Proc. U. S. Nat. Mus., vol. 52, p. 677, pl. 46, fig. 6.
Kyska Harbor, Aleutian Islands.

ALVANIA COSMIA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 352, pl. 31, fig. 4.
San Pedro, California, to San Martin Island, to Lower California.

ALVANIA PURPUREA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 116; Proc. U. S. Nat. Mus., vol. 41, pl. 31, fig. 1.
Monterey, California, to San Martin Island, Lower California.

ALVANIA AEQUISCULPTA Keep, 1887.
West Coast Shells, p. 65; Proc. U. S. Nat. Mus., vol. 41, p. 358, pl. 32, fig. 7.
Catalina Island to Todos Santos Bay.

ALVANIA ALMO Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 359, pl. 32, fig. 1.
Santa Barbara Island, California.

ALVANIA OLDROYDAE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 41, p. 361, pl. 32, fig. 2.
San Pedro, California, to South Coronado Island.

Family RISSOINIDAE.

Genus RISSOINA Orbigny, 1840.

RISSOINA KELSEYI Dall and Bartsch, 1902.
Nautilus, vol. 16, p. 94; Proc. U. S. Nat. Mus., vol. 49, p. 49, pl. 30, fig. 4.
San Pedro, California, to the Coronado Islands.

RISSOINA CALIFORNICA Bartsch, 1915.
Proc. U. S Nat. Mus., vol. 49, p. 55, pl. 33, fig. 1.
Catalina Island to South Coronado Island.

RISSOINA BAKERI Bartsch, 1902.
Nautilus, vol. 16, p. 9; Proc. U. S. Nat. Mus., vol. 49, p. 56, pl. 33, fig. 4.
San Pedro, California, to Coronado Islands.

RISSOINA NEWCOMBEI Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Columbia, No. 2, p. 14, pl. 1, fig. 12.
Forrester Island, Alaska, to Vancouver Island.

RISSOINA CLEO Bartsch, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 58, pl. 33, fig. 3.
South Coronado Island.

RISSOINA DALLI Bartsch, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 59, pl. 33, fig. 2.
San Pedro, California, to South Coronado Island.

RISSOINA CORONADOËNSIS Bartsch, 1915.
Proc. U. S. Nat. Mus., vol. 49, p. 60, pl. 33, fig. 8.
San Diego, California, to San Martin Island, Lower California.

Family ANAPLOCAMIDAE.

Genus ANAPLOCAMUS Dall, 1895.

ANAPLOCAMUS BOREALIS Dall, 1895.
Proc. U. S. Nat. Mus., vol. 24, p. 550, pl. 38, fig. 4.
South of Unimak Island, Alaska, in 61 fathoms. (U. S. Bureau of Fisheries).

Family TRUNCATELLIDAE.

Genus TRUNCATELLA (Leach, 1818) Risso, 1826.

TRUNCATELLA CALIFORNICA Pfeiffer, 1857.
Proc. Zool. Soc., p. 111.—BINNEY, Terr. Moll., vol. 4, pl. 79, figs. 20, 22.
Santa Barbara to San Diego and San Martin Island, California.

TRUNCATELLA STIMPSONI Stearns, 1872.
Proc. Cal. Acad. Sci., vol. 4, p. 248, pl. 1, fig. 5.
Catalina Island, California, to Magdalena Bay, Lower California.

Family SYNCERATIDAE.

Genus SYNCERA Gray, 1821.

SYNCERA TRANSLUCENS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., 1863, pp. 613, 657; Proc. Cal. Acad. Sci., vol. 3, p. 219.
Vancouver Island to Lower California.

Family CAPULIDAE.

Genus CAPULUS Montfort, 1810.

CAPULUS CALIFORNICUS Dall, 1900. **(Plate 15, fig. 6.)**
Nautilus, vol. 13, No. 9, p. 100.
San Pedro to San Diego, on Pectens.

Genus PILISCUS Lovèn, 1859.

PILISCUS COMMODUS Middendorff, 1851.
Sibirische Reise, vol. 2, p. 214, pl. 17, figs. 4–11.
Arctic Ocean to Pribilof Islands, Bering Sea, and the Okhotsk Sea.

Family HIPPONICIDAE.

Genus HIPPONIX Defrance, 1819.

HIPPONIX BARBATUS Sowerby, 1835.
Proc. Zool. Soc., p. 5.—Tryon, Man., vol. 8, pl. 40, figs. 2–3.
Crescent City, California, to Panama and the Galapagos Islands.

HIPPONIX SERRATUS Carpenter, 1857.
Mazatlan Cat., p. 296.—Tryon, Man., vol. 8, pl. 100, fig. 40.
Monterey, California, to Panama.

HIPPONIX ANTIQUATUS Linnaeus, 1767.
Syst. Nat., ed. 12, p. 1259.—Tryon, Man., vol. 8, pl. 40, figs. 93–97.
Crescent City, California, to Panama and the Galapagos Islands.

HIPPONIX ANTIQUATUS CRANIOIDES Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 427.—Tryon, Man., vol. 8, pl. 40, fig. 6.
Vancouver Island to San Pedro, California.

HIPPONIX TUMENS Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 180.—Tryon, Man., vol. 8, pl. 40, fig. 7.
Crescent City, California, to San Diego.

Family CREPIDULIDAE.

Genus CREPIDULA Lamarck, 1801.

Section CREPIDULA s. s.

CREPIDULA GRANDIS Middendorff, 1849.
Mal. Rossica, p. 101.—Tryon, Man., vol. 8, pl. 37, fig. 33.
Cape Franklin, Arctic Ocean, south and east to Sitka, Alaska. Also Kamchatka.

CREPIDULA ONYX Sowerby, 1825.
Genera of Shells, No. 23, fig. 2.
Monterey, California, to Panama.

CREPIDULA NORRISIARUM Williamson, 1905.
Nautilus, vol. 19, No. 5, p. 51.
San Pedro, on *Norrisia* only.

CREPIDULA EXCAVATA Broderip, 1834.
Proc. Zool. Soc., p. 46; Trans., vol. 1, p. 205, pl. 29, fig. 7.
Monterey, California, to Payta, Peru.

CREPIDULA EXCAVATA NATICARUM Williamson, 1905.
Nautilus, vol. 19, No. 5, p. 50.
San Pedro, on *Natica*.

CREPIDULA INCURVA Broderip, 1834.
Proc. Zool. Soc., p. 40; Trans., vol. 1, p. 204, pl. 29, fig. 6.
San Pedro, California, to Panama.

CREPIDULA ORBICULATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 351.
Bering Sea to San Diego, California.

CREPIDULA CONVEXA GLAUCA Say, 1822.
Journ. Acad. Nat. Sci. Phila., vol. 2, p. 226.—Tryon, Man., vol. 8, pl. 36, fig. 9.
Alameda, California. Introduced with Atlantic seed oysters.

CREPIDULA ADUNCA Sowerby, 1825.
Tankerville Cat. App., p. vii, No. 828.—Keep, West Coast Shells, p. 207, fig. 201.
Vancouver Island to Cape San Lucas.

CREPIDULA ACULEATA Gmelin, 1792.
Syst. Nat., vol. 7, p. 3693.—Tryon, Man., vol. 8, pl. 39, figs. 61–63.
Santa Barbara, California, to Valparaiso, Chile.

Subgenus Crepipatella Lesson, 1830.

CREPIPATELLA LINGULATA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 160; Rep. U. S. Expl. Exp., Moll., figs. 481 *a–c*.
Bering Sea to Panama.

Subgenus IANACUS Mörch, 1852.

IANACUS NUMMARIUS Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 160; Rep. U. S. Expl. Exp., Moll., figs. 480 *a–b*.
Plover Bay, Bering Strait, to Mazatlan.

IANACUS NUMMARIUS FIMBRIATUS Reeve, 1859.
Conch. Icon., *Crepidula*, fig. 11.
Vancouver Island to Gulf of California.

IANACUS NUMMARIUS PERFORANS Valenciennes, 1846.
Voy. *Venus*, Atlas, pl. 24, fig. 9.
Monterey, California, to Panama, in *Pholas* borings.

IANACUS NUMMARIUS GLOTTIDIARUM Dall, 1905.
Nautilus, vol. 19, No. 3, p. 26.
San Pedro, California, on *Glottidia albida* only.

Family CALYPTRAEIDAE.

Genus CRUCIBULUM Schumacher, 1817.

CRUCIBULUM SPINOSUM Sowerby, 1824.
Genera of Shells, *Calyptraea*, figs. 4, 7.
Trinidad, California, to Tome, Chile, and the Galapagos Islands.

Genus CALYPTRAEA Lamarck, 1799.

CALYPTRAEA FASTIGIATA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 161; Rep. U. S. Expl. Exp., Moll., figs. 484 *a–b*.
Port Etches, Alaska, to Puget Sound.

CALYPTRAEA CONTORTA Carpenter, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 215.
Catalina Island, California, to Gulf of California.

NATICACEA.

Family NATICIDAE.

Genus NATICA Scopoli, 1777.

Subgenus CRYPTONATICA Dall, 1892.

CRYTONATICA CLAUSA Broderip and Sowerby, 1829. **(Plate 14, fig. 11.)**
Zool. Journ., vol. 4, p. 372.—TRYON, Man., vol. 8, pl. 9, fig. 65.
Arctic and Bering Seas, south, in gradually deepening water, to Japan on the west and San Diego, California, on the east.

CRYPTONATICA RUSSA Gould, 1859.
Proc. Boston Soc. Nat. Hist., vol. 7, p. 43.
Bering Strait to Forrester Island, Alaska.

CRYPTONATICA AFFINIS Gmelin, 1792.
Syst. Nat., vol. 7, p. 3675.—Sars, Moll. Reg. Arct. Norv., pl. 21, fig. 14.
Arctic Ocean north of Bering Strait. Also Greenland.

CRYPTONATICA JANTHOSTOMA Deshayes, 1841. (Plate 14, fig. 12.)
Guérin, Mag. de Zool., Moll., pl. 45.
Commander Islands, Bering Sea; Kamchatka and south to Japan.

CRYPTONATICA ALEUTICA Dall, 1919. (Plate 14, fig. 10.)
Proc. U. S. Nat. Mus., vol. 56, p. 352; Proc. Biol. Soc. Wash., vol. 32, p. 251.
North end of Nunivak Island, Bering Sea; south on the west from Kamchatka to Japan; on the east to the Aleutian chain and Puget Sound.

CRYPTONATICA SALIMBA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 351.
Off Esteros Bay, California, and south to the Gulf of California, in deep water.

Genus POLINICES Montfort, 1810.

Subgenus Euspira Agassiz, 1842.

EUSPIRA PALLIDA Broderip and Sowerby, 1829. (Plate 14, fig. 5.)
Zool. Journ., vol. 5, pt. 4, p. 372.—Tryon, Man., vol. 8, pl. 14, fig. 26.
Arctic Ocean at Point Barrow and southward on the east to Forrester Island, Alaska. On the west at the island of Kolguief in the Polar Sea and in the Okhotsk Sea (Middendorff).

EUSPIRA GRÖNLANDICA (Beck) Moller, 1842.
Ind. Moll. Grönl., p. 7.—Sars, Moll. Reg. Arct. Norv., pl. 21, fig. 15.
Arctic Seas southward in gradually deeper water to Monterey, California. Also Greenland.

EUSPIRA ACOSMITA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 352.
San Clemente Island, California, to the Coronado Islands, in deep water.

EUSPIRA MONTERONA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 352.
Arctic Ocean, Bering Sea, and the Aleutians.

EUSPIRA ALGIDA Gould, 1848?
Proc. Boston Soc. Nat. Hist., vol. 3, p. 73; Rep. U. S. Expl. Exp., Moll., fig. 256.
Coal Harbor, Shumagin Islands, Alaska to Puget Sound. "Rio Negro" (Gould).

EUSPIRA POLITIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 353.
Petrel Bank, Bering Sea.

EUSPIRA CAURINA Gould, 1847.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 239; Rep. U. S. Expl. Exp., Moll., fig. 254.
Norton Sound, Alaska, to Puget Sound, and in deep water (822 fathoms) to San Diego, California.

EUSPIRA CANONICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 353.
Off Alaska Peninsula in 1,365 fathoms, and off San Diego, California, in 822 fathoms.

EUSPIRA LEWISII Gould, 1847.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 239; Rep. U. S. Expl. Exp., Moll., fig. 253.
Duncan Bay, British Columbia, to the Santa Barbara Islands, California.

EUSPIRA DRACONIS Dall, 1903. (Plate 14, figs. 4, 6.)
Proc. Biol. Soc. Wash., vol. 16, p. 174.
Port Althorp, Alaska, to Catalina Island, California.

Subgenus NEVERITA Risso, 1826.

NEVERITA RECLUZIANA Deshayes, 1841.
GUÉRIN, Mag. de Zool., Moll., pl. 37.
Crescent City, California, to the Tres Marias Islands. Chile (Philippi).

NEVERITA RECLUZIANA IMPERFORATA Dall, 1909.
U. S. Geol. Surv., Prof. Paper 59, p. 88.
Crescent City to San Diego, California.

NEVERITA RECLUZIANA ALTA Dall, 1909.
U. S. Geol. Surv., Prof. Paper 59, p. 88.
Monterey to Catalina Island, California.

Subgenus POLINICES s. s.

POLINICES NANUS Moller, 1842.
Index Moll. Grönl., p. 7.—SARS, Moll. Reg. Arct. Norv., pl. 21, fig. 16.
Arctic Ocean to the Aleutians and southward in gradually deeper water to near San Diego, California (640 fathoms). Also Greenland.

Genus SINUM Bolten, 1798.

SINUM CALIFORNICUM Oldroyd, 1917.
Nautilus, vol. 31, No. 1, p. 13.
Monterey, California, to Todos Santos Bay, Lower California.

SINUM DEBILE Gould, 1852.
Proc. Boston Soc. Nat. Hist., vol. 6, p. 395.—TRYON, Man., vol. 7, pl. 24, fig. 65.
Catalina Island, California, to Gulf of California.

SINUM PAZIANUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 354.
Catalina Island, California, to Panama.

SINUM KERATIUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 354.
Catalina Island, California.

Genus EUNATICINA Fischer, 1855.

EUNATICINA OLDROYDII Dall, 1897. (Plate 14, figs. 1, 3.)
Nautilus, vol. 11, No. 8, p. 85; vol. 13, No. 8, p. 85, 1899.
Oregon to San Diego, California.

Genus ELACHISINA Dall, 1918.

ELACHISINA GRIPPI Dall, 1918.

Proc. Biol. Soc. Wash., vol. 31, p. 137; Proc. U. S. Nat. Mus., vol. 56, p. 354, 1919.

Off San Diego, California, in 16 to 20 fathoms.

Genus BULBUS Brown, 1839.

BULBUS FRAGILIS (Leach, 1819) APERTUS (Lovèn) Middendorff, 1851.

Journ. de Phys., vol. 88, p. 464; Midd., Sibirische Reise, pl. 11, figs. 1–3.

Icy Cape, Arctic Ocean, south to the Aleutian Islands and eastward to the Shumagin Islands.

Genus AMAUROPSIS Mörch, 1857.

AMAUROPSIS PURPUREA Dall, 1871.

Amer. Journ. Conch., vol. 7, p. 124, pl. 15, fig. 16; Proc. U. S. Nat. Mus., vol. 24, pl. 38, fig. 9 (?Zool. Beechey's Voy., pl. 37, fig. 4, 1839).

Arctic coast westward from Bernard Harbor, to Point Barrow and south to Plover Bay and Nunivak Island, Bering Sea.

NARICACAE?

Family VANICOROIDAE?

Genus MEGALOMPHALUS Brusina, 1871.

MEGALOMPHALUS CALIFORNICUS Dall, 1903. (Plate 14, fig. 7.)

Proc. Biol. Soc. Wash., vol. 16, p. 175.

Santa Barbara Islands, California.

MARSENIACEA

Family LAMELLARIIDAE.

Genus LAMELLARIA Montagu, 1815.

LAMELLARIA STEARNSII Dall, 1871.

Amer. Journ. Conch., vol. 7, pt. 2, p. 122, pl. 15, fig. 6.

Puget Sound to Monterey, California.

LAMELLARIA STEARNSII ORBICULATA Dall, 1871.

Amer. Journ. Conch., vol. 7, pt. 2, p. 122, pl. 15, figs. 2, 3.

Sannakh Islands, Alaska, to Gulf of California.

LAMELLARIA DIEGOËNSIS Dall, 1885.

Proc. U. S. Nat. Mus., vol. 8, p. 538, pl. 24, figs. 1, 2, 3.

San Pedro and the islands to San Diego, California.

LAMELLARIA DIGUETI Rochebrune, 1895.

Mus. d'Hist. Nat., Paris, Bull. 1, p. 240.

San Pedro, California, to Gulf of California.

Section MARSENINA Gray, 1850.

LAMELLARIA RHOMBICA Dall, 1871.
Amer. Journ. Conch., vol. 7, pt. 2, p. 122, pl. 15, figs. 4, 5.
Neah Bay, Washington, to Magdalena Bay, Lower California.

Genus ONCHIDIOPSIS Bergh, 1853.

ONCHIDIOPSIS HANNAI Dall, 1916.
Proc. Acad. Nat. Sci. Phila., p. 376.
St. Paul Island, Pribilof group, Bering Sea.

Family VELUTINIDAE.

Genus VELUTINA Fleming, 1822.

VELUTINA PROLONGATA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 32.
Bering Strait to Monterey, California.

VELUTINA ZONATA Gould, 1841.
Invert. Mass., p. 242, fig. 160.
Icy Cape, Arctic Ocean, to Monterey, California; also Atlantic.

VELUTINA LAEVIGATA (Linnaeus) Müller, 1776.
Syst. Nat., ed. 12, p. 1250; Zool. Danica, pl. 101, figs. 1-4.
Icy Cape, Arctic Ocean, to Monterey, California; also Atlantic.

VELUTINA CONICA Dall, 1886.
Proc. U. S. Nat. Mus., vol. 9, p. 305, pl. 3, fig. 10.
Aleutian Islands eastward to Kodiak and south to Forrester Island, Alaska.

VELUTINA GRANULATA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 355.
Monterey, California, in 55 fathoms.

VELUTINA CORIACEA Pallas, 1788.
Nov. Acta Acad. Petrop., vol. 2, p. 237.—Tryon, Man., vol. 8, pl. 28, figs. 49, 50.
Bering Sea, and the Okhotsk Sea.

VELUTINA CRYPTOSPIRA Middendorff, 1849.
Mal. Rossica, pt. 2, p. 106; Sibirische Reise, pl. 25, figs. 8, 9, 10.
Gulf of Alaska.

VELUTINA SITKENSIS A. Adams, 1851.
Proc. Zool. Soc., p. 283.
Bering Sea; Sitka, Alaska (Adams).

Genus TORELLIA Lovèn, 1867.

TORELLIA AMMONIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 355.
Southwest of Sannakh Island, Alaska, in 41 fathoms.

TORELLIA VALLONIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 355.
Nazan Bay, Atka Island, Aleutians.

Superfamily DOCOGLOSSA.

Family LEPETIDAE.

Genus LEPETA Gray, 1847.

Subgenus CRYPTOCTENIDIA Dall, 1918.

CRYPTOCTENIDIA CONCENTRICA Middendorff, 1851.

Sibirische Reise, p. 183, pl. 16, fig. 6; Amer. Journ. Conch., vol. 5, pt. 3, pl. 15, fig. 2.

Icy Cape, Arctic Ocean, on the west to the Okhotsk Sea and Shantar Islands on the east to Forrester Island, Alaska.

CRYPTOCTENIDIA CAECOIDES Carpenter, 1865.

Proc. Acad. Nat. Sci. Phila., p. 60.

Arctic and Bering Seas to Hakodate, Japan, the Aleutian Islands, and south to the Farallones Islands, California.

CRYPTOCTENIDIA ALBA Dall, 1869.

Amer. Journ. Conch., vol. 5, pt. 3, p. 145, pl. 15, figs. 3 *a–d*.

Bering Strait and sea south to Fuca Strait.

CRYPTOCTENIDIA ALBA INSTABILIS Dall, 1869.

Amer. Journ. Conch., vol. 5, pt. 3, p. 145, pl. 15, fig. 6.

Unalashka to the Shumagins and south to Sitka Sound, Alaska.

Family ACMAEIDAE.

Genus ACMAEA Eschscholtz, 1830.

(See Nautilus, June, 1914.)

ACMAEA MITRA Eschscholtz, 1833.

Zool. Atlas, p. 18, pl. 23, fig. 4; Amer. Journ. Conch., vol. 5, pl. 15, figs. 5 *a–c*.

Pribilof Islands, Bering Sea, to San Diego, California.

ACMAEA MITRA FUNICULATA Carpenter, 1864.

Suppl. Rep. Brit. Assoc., p. 650.

Shumagin Islands, Alaska, to Magdalena Bay, Lower California.

Section COLLISELLA Dall, 1871.

ACMAEA CASSIS Eschscholtz, 1833.

Zool. Atlas, p. 19, pl. 24, fig. 3.

Aleutian Islands to San Francisco, California.

ACMAEA CASSIS PELTA Eschscholtz, 1833.

Zool. Atlas, p. 10.—Tryon, Man., vol. 13, pl. 8, figs. 90, 91.

Okhotsk and Southern Bering Sea, Nushagak, Alaska, the Aleutian Islands south to Rosario Bay, Lower California, and Socorro Island.

ACMAEA CASSIS OLYMPICA Dall, 1914.

Nautilus, vol. 28, No. 2, p. 14.—Tryon, Man., vol. 13, pl. 8. figs. 92–94.

Alaska Peninsula south to San Diego, California.

ACMAEA CASSIS NACELLOIDES Dall, 1871.
Amer. Journ. Conch., vol. 6, p. 247, pl. 17, figs. 36 *a–c*.
Attu Island, Aleutians, east and south to San Diego, California, on kelp.

ACMAEA CASSIS MONTICOLA Carpenter, 1866.
Amer. Journ, Conch., vol. 2, p. 337.
Monterey, California.

ACMAEA SCUTUM Eschscholtz, 1833.
Zool. Atlas, pt. 5, p. 19, pl. 23, figs. 1–3.
Southern Bering Sea to Tugur Bay and the Shantar Islands on the west, and from the Pribilof and Aleutian Islands on the east south to the Gulf of California and Socorro Island.

ACMAEA SCUTUM PATINA Eschscholtz, 1833.
Zool. Atlas, pt. 5, p. 19, pl. 24, figs. 7, 8.
Same distribution as the typical form.

ACMAEA SCUTUM PINTADINA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 151.—TRYON, Man., vol. 13, pl. 9, fig. 6.
Aleutian Islands to Monterey, California.

ACMAEA SCUTUM CRIBRARIA Carpenter, 1866.
Amer. Journ. Conch., vol. 2, p. 335.
Neah Bay, Washington, to Santa Barbara, California.

ACMAEA SCUTUM OCHRACEA Dall, 1871.
Amer. Journ. Conch., vol 6. p. 249, pl. 17, fig. 35.
Monterey, California.

ACMAEA SCUTUM PARALLELA Dall, 1914.
Nautilus, vol. 28, No. 2, p. 14; Amer. Journ., Conch., vol. 6, p. 250, pl. 14. fig. 13.
Sitka, Alaska, to Victoria, British Columbia, on eel grass.

ACMAEA EMYDIA Dall, 1914.
Nautilus, vol. 28, No. 2, p. 14; Amer. Journ. Conch., vol. 6, p. 250, ex parte.
Arctic Ocean and Northern Bering Sea to Nushagak, Alaska, the Pribilof Islands, and Attu Island.

ACMAEA PERAMABILIS Dall, 1872.
Proc. Cal. Acad. Sci., vol. 4, p. 302.—TRYON, Man., vol. 13, pl. 33, figs. 80–82.
Shumagin Islands, Alaska, on granite rocks only.

ACMAEA DIGITALIS Eschscholtz, 1833.
Zool. Atlas, vol. 5, p. 20, pl. 23, figs. 7, 8.
Aleutian Islands to Monterey, California.

ACMAEA DIGITALIS UMBONATA Reeve, 1855.
Conch. Icon., *Patella*, fig. 107.
Saginaw Bay, Alaska.

ACMAEA DIGITALIS TEXTILIS Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 152; Rep. U. S. Expl. Exp., Moll., pl. 29, fig. 456.
Tillamook, Oregon. south to Socorro Island.

ACMAEA LIMATULA Carpenter, 1866.

Amer. Journ. Conch., vol. 6, p. 340.—TRYON, Man., vol. 13, p. 14, pl. 3, figs. 38–40.

Crescent City, California, to Cerros and Socorro Islands.

ACMAEA LIMATULA MÖRCHII Dall, 1878.

Proc. U. S. Nat. Mus., vol. 1, p. 47.—TRYON, Man., vol. 13, pl. 3, figs. 47–49.

Tomales Bay, California.

ACMAEA SCABRA Gould, 1846.

Proc. Boston Soc. Nat. Hist., vol. 2, p. 152.—TRYON, Man., vol. 13, pl. 1, figs. 7, 9.

San Francisco, California, to Socorro Island.

ACMAEA SYBARITICA Dall, 1871.

Amer. Journ. Conch., vol. 6, p. 257. pl. 17, fig. 34.—TRYON, Man., vol. 13, pl. 9, figs. 22–24.

Plover Bay, Eastern Siberia, to Hakodate, Japan, on the west; on the east from the Pribilof and Aleutian Islands, to Chirikoff Island.

ACMAEA APICINA Dall, 1879.

Proc. U. S. Nat. Mus., vol. 1, p. 403.—TRYON, Man., vol. 13, pl. 7, figs. 66, 67.

Pribilof, Aleutian, and Shumagin Islands, Alaska.

ACMAEA PERSONA Eschscholtz, 1833.

Zool. Atlas., vol. 5, p. 20, pl. 24, figs. 1, 2.

Shumagin Islands, Alaska, to Socorro Island.

ACMAEA PERSONA STRIGILLATA Carpenter, 1866.

Suppl. Rep. Brit. Assoc., p. 618; Amer. Journ. Conch., vol. 2, p. 337.

Sitka, Alaska, to Magdalena Bay, Lower California.

ACMAEA ROSACEA Carpenter, 1866.

Amer. Journ. Conch., vol. 2, p. 341.—TRYON, Man., vol. 13, pl. 7, figs. 71–73.

Neah Bay, Washington, to Acapulco, Mexico.

ACMAEA INSTABILIS Gould, 1846.

Proc. Boston Soc. Nat. Hist., vol. 2, p. 150.—TRYON, Man. vol. 13, pl. 6, figs. 32, 33.

Kodiak Island to San Pedro, on kelp stalks.

ACMAEA INSESSA Hinds, 1842.

Ann. Mag. Nat. Hist., vol. 10, p. 82, pl. 6, fig. 3.—TRYON, Man., vol. 13, pl. 6, figs. 336, 37.

Trinidad, California, to Magdalena Bay, Lower California, on kelp.

ACMAEA ASMI Middendorff, 1849.

Mal. Rossica, vol. 2, p. 39, pl. 1, fig. 5.—TRYON, Man., vol. 13, pl. 6, figs. 38, 39.

Sitka, Alaska, to San Diego, California, and Socorro Island, on black Tegulas.

ACMAEA DEPICTA Hinds, 1842.

Ann. Mag. Nat. Hist., vol. 10, p. 82, pl. 6, fig. 4.—TRYON, Man., vol. 13, pl. 6, figs. 40, 41.

Santa Barbara to Lower California, on *Zostera*.

ACMAEA PALEACEA Gould, 1851.
Mex. and Cal. Shells, p. 3, pl. 14, fig. 5.—TRYON, Man., vol. 13, p. 6, fig. 42.
Trinidad to Lower California on *Zostera.*

ACMAEA TRIANGULARIS Carpenter, 1866.
Pal. Cal. Acad. Sci., vol. 3, p. 213.—TRYON, Man., vol. 13, pl. 7, figs. 74–78.
Sitka, Alaska, to the Gulf of California, on sea grasses.

Section RHODOPETALA Dall, 1920.

? ACMAEA ROSEA Dall, 1872.
Proc. Cal. Acad. Sci., vol. 4, p. 270, pl. 1, fig. 2.
Kyska Island, Aleutians, to the Shumagin Islands, Alaska.

Genus LOTTIA Gray, 1834.

LOTTIA GIGANTEA Gray, 1834.
SOWERBY, Genera of Shells, *Lottia*, fig. 1.—TRYON, Man., vol. 13, pl. 38.
Crescent City, California, south to Guadelupe and Cerros Islands.

LOTTIA GIGANTEA ALBOMACULATA Dall, 1910.
Nautilus, vol. 24, No. 8, p. 96.
Crescent City, California, to Rosario Bay, Lower California.

Superfamily RHIPIDOGLOSSA.

Family COCCULINIDAE.

Genus COCCULINA Dall, 1881.

COCCULINA AGASSIZII Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 340.
Off Queen Charlotte Islands, British Columbia, 145 fathoms. Gulf of Panama, 556 fathoms.

COCCULINA CAZANICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 356.
Kasaän Bay and Stephens Passage, Alaska, 95 to 160 fathoms.

Family PHASIANELLIDAE.

Genus PHASIANELLA Lamarck, 1804.

Subgenus TRICOLIA Risso, 1826.

TRICOLIA COMPTA Gould, 1855.
H. Reps. Doc. 129, Prelim. Rep., p. 25; Pacific R. R. Reps., vol. 5, pl. 11, figs. 25, 26.—TRYON, Man., vol. 10, pl. 39, figs. 69–72.
Monterey to Gulf of California.

TRICOLIA COMPTA PUNCTULATA Carpenter, 1865.
Ann. Mag. Nat. Hist., vol. 15, p. 179.
San Diego, California, to Cape San Lucas, Lower California.

TRICOLIA COMPTA PRODUCTA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 256.—Tryon, Man., vol. 10, p. 173, pl. 39, fig. 69.
San Pedro, California.

TRICOLIA PULLOIDEA Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 180.
Monterey, California, to Lower California.

TRICOLIA PULLOIDEA ELATIOR Carpenter, 1865.
Ann. Mag. Nat. Hist., ser. 3, vol. 15, p. 180.
Monterey to San Diego, California.

Subgenus EULITHIDIUM Pilsbry, 1898.

EULITHIDIUM TYPICUM Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, p. 255.
San Luis Obispo, California, to Cape San Lucas.

EULITHIDIUM SUBSTRIATUM Carpenter, 1864.
Ann. Mag. Nat. Hist., vol. 13, p. 475.
Catalina Island, California, to Panama.

EULITHIDIUM LURIDUM Dall, 1897.
Bull. Nat. Hist. Soc. Brit. Col., No. 2, p. 15, pl. 1, fig. 11.
Vancouver Island to Mendocino County, California.

Family TURBINIDAE.

Genus ASTRAEA Bolten, 1798.

Subgenus POMAULAX Gray, 1850.

POMAULAX UNDOSUS Wood, 1828.
Index Test. Suppl., p. 16, pl. 5, *Trochus*, fig. 1.
Laguna Beach, California, to Cerros Island, Lower California.

Subgenus PACHYPOMA Gray, 1850.

PACHYPOMA INAEQUALE Martyn, 1784.
Figs. Nondescript Shells, tab. 1, pl. 31.
Vancouver Island, British Columbia, to San Pedro and the Santa Barbara Islands, California.

PACHYPOMA INAEQUALE PACIFICUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 356.
Pacific Beach, San Diego County, California.

PACHYPOMA BARBARENSE Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 357.
Off Santa Cruz Island, California, in 30 fathoms.

Genus LEPTOTHYRA (Carpenter) Pease, 1869.

LEPTOTHYRA CARPENTERI Pilsbry, 1888.
Tryon, Man., vol. 10, p. 247, pl. 39*a*, fig. 26; pl. 60, fig. 66.
Sitka Sound, Alaska, to San Diego, California.

LEPTOTHYRA LURIDA Dall, 1885.
Proc. U. S. Nat, Mus., vol. 8, p. 542.—TRYON, Man., vol. 10, pl. 39*a*, figs. 27–29.?
Puget Sound to Cape San Lucas.

LEPTOTHYRA BACULA Carpenter, 1864.
Proc. Cal. Acad. Sci., vol. 3, pp. 177, 188.—TRYON, Man., vol. 10, pl. 39*a*, fig. 33.
Puget Sound to San Martin Island, Lower California.

LEPTOTHYRA PAUCICOSTATA Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 134, pl. 15, fig. 10.
Monterey to Coronado Islands.

LEPTOTHYRA PAUCICOSTATA FENESTRATA Bartsch, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 358.
Monterey to Coronado Islands.

LEPTOTHYRA JUANENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 358.
San Diego, California, to Tia Juana, Lower California.

LEPTOTHYRA GRIPPI Dall, 1911.
Nautilus, vol. 25, No. 3, p. 25.
San Diego, California, 100 to 150 fathoms.

Family LIOTIIDAE.

Genus LIOTIA Gray, 1847.

LIOTIA FENESTRATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 652; Proc. Cal. Acad. Sci., vol. 3, p. 158.—TRYON, Man., vol. 10, pl. 36, fig. 97.
Monterey to Catalina Island, California.

LIOTIA ACUTICOSTATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 652; Proc. Cal. Acad. Sci., vol. 3, p. 158.—TRYON, Man., vol. 10, pl. 36, fig 1.
Catalina Island, California, to Magdalena Bay, Lower California.

LIOTIA ACUTICOSTATA RADIATA Dall, 1919.
Proc. Biol. Soc. Wash., vol. 31, p. 8.
San Diego and Coronado Islands.

Subgenus ARENE H. and A. Adams, 1854.

ARENE COOKEANA Dall, 1918.
Proc. Biol. Soc. Wash., vol. 31, p. 8.
South Coronado Island to Gulf of California.

Subgenus CYNISCA H. and A. Adams, 1854.

CYNISCA FRICKI Crosse, 1865.
Journ. de Conchyl., vol. 13, p. 55.
"California" (Frick). ? West Indies.

Genus MOLLERIA Jeffreys, 1865.

MOLLERIA DRUSIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 358.
Amchitka Island to Glacier Bay, Alaska.

MOLLERIA QUADRAE Dall, 1897.
Bull. Nat. Hist. Soc. Brit., Col. No. 2, p. 15, pl. 1, fig. 14.
Amchitka Island, Aleutians, to Queen Charlotte Islands, British Columbia.

Family TROCHIDAE.

Genus NORRISIA Bayle, 1880.

NORRISIA NORRISII Sowerby, 1838.
Mag. Nat. Hist., new ser., vol. 2, p. 96.—Tryon, Man., vol. 11, pl. 61, fig. 80.
Monterey, California, to Cerros Island, Lower California.

Genus HALISTYLUS Dall, 1889.

HALISTYLUS SUBPUPOIDEUS Tryon, 1887.
Man., vol. 9, p. 394, pl. 60, fig. 77.
Queen Charlotte Islands, British Columbia, to Panama Bay.

Genus TEGULA Lesson, 1832.

Subgenus CHLOROSTOMA Swainson, 1840.

CHLOROSTOMA FUNEBRALE A. Adams, 1854.
Proc. Zool. Soc., p. 316.—Tryon, Man., vol. 11, p. 170, pl. 28, figs. 42–44.
Vancouver Island to Cerros Island, Lower California.

CHLOROSTOMA FUNEBRALE SUBAPERTUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 652.
Neah Bay, Washington, and southward.

CHLOROSTOMA GALLINA Forbes, 1850.
Proc. Zool. Soc., p. 271.—Tryon, Man., vol. 11, p. 20, fig. 5, pl. 28, figs. 52, 53.
San Francisco Bay to Gulf of California.

CHLOROSTOMA GALLINA MULTIFILOSUM Stearns, 1893.
Proc. U. S. Nat. Mus., vol. 16, p. 351, pl. 1, figs. 8, 9.
San Pedro, California, to Guadelupe Island.

CHLOROSTOMA GALLINA TINCTUM (Hemphill) Pilsbry, 1893.
Tryon, Man., vol. 11, p. 109.
Halfmoon Bay, California, and south to San Diego and Socorro Island.

CHLOROSTOMA GALLINA UMBILICATUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 359.
San Diego, California, to San Quentin Bay, Lower California.

CHLOROSTOMA BRUNNEUM Philippi, 1848.
Zeitschr. für Mal., p. 189.—Tryon, Man., vol. 11, p. 170, pl. 27, figs. 36–38.
Mendocino County, California, to Santa Barbara Islands.

CHLOROSTOMA BRUNNEUM FLUCTUOSUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 359.
Purissima to San Nicolas Island, California.

CHLOROSTOMA RUGOSUM A. Adams, 1851.
Proc. Zool. Soc., p. 182.—Tryon, Man., vol. 11, pl. 26, fig. 26.
San Diego, California, to Acapulco, Mexico.

CHLOROSTOMA MONTEREYI Kiener, 1850.
Coq. Vivantes, *Trochus*, pl. 33, fig. 1.
Baulinas Bay to Santa Barbara Islands, California.

CHLOROSTOMA REGINA Stearns, 1893.
Proc. U. S. Nat. Mus., vol. 16, p. 350, pl. 50, figs. 6, 7.
Catalina and San Clemente Islands, California, to Magdalena Bay, Lower California, and Guadelupe Island.

Subgenus Promartynia Dall, 1909.

PROMARTYNIA PULLIGO Martyn, 1784. (Plate 17, figs. 5, 6.)
Figs. Nondescript Shells, table 2, pl. 76.—Tryon, Man., vol. 11, pl. 26, figs. 23–25.
Sitka, Alaska, to Santa Barbara Islands, California.

Subgenus Omphalius Philippi, 1847.

OMPHALIUS AUREOTINCTUS Forbes, 1850.
Proc. Zool. Soc., p. 271, pl. 11, fig. 7.
Santa Barbara Islands, California, to Magdalena Bay.

OMPHALIUS IMPRESSUS Jonas, 1848.
Conch. Cab., ed. 2, *Trochus*, p. 318, pl. 45, fig. 6.
San Diego, California (Cooke), to Tres Marias Island.

OMPHALIUS LIGULATUS Menke, 1850.
Zeitschr. f. Mal., p. 173.—Tryon, Man., vol. 11, pl. 29, figs. 58–60.
Monterey, California, to Acapulco, Mexico.

OMPHALIUS RETICULATUS Wood, 1828.
Index Test. Suppl., pl. 6, fig. 38.—Tryon, Man., vol. 11, pl. 29, figs. 63, 64.
San Pedro, California, to Panama.

OMPHALIUS MARIANUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 359.—Tryon, Man., vol. 11, pl. 24, figs. 80–83.
Santa Barbara Island, to Payta, Peru.

Genus CALLIOSTOMA Swainson, 1840.

CALLIOSTOMA COSTATUM Martyn, 1784.
Figs. Nondescript Shells, table 1, pl. 34.—Tryon, Man., vol. 11, pl. 16, figs. 6, 9.
Sitka, Alaska, to San Diego, California.

CALLIOSTOMA COSTATUM CAERULEUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 359.
Neah Bay, Washington, to Monterey, California.

CALLIOSTOMA COSTATUM PICTUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 359.
Neah Bay, Washington, to Monterey, California.

CALLIOSTOMA ANNULATUM Martyn, 1784.
Figs. Nondescript Shells, table 1, pl. 33.—TRYON, Man., vol. 11, pl. 67, fig. 43.
Forrester Island, Alaska, to Catalina Island, California.

CALLIOSTOMA CANALICULATUM Martyn, 1784.
Figs. Nondescript Shells, table 1, pl. 32.—TRYON, Man., vol. 10, pl. 41, fig. 34.
Sitka, Alaska, to San Diego, California.

CALLIOSTOMA CANALICULATUM NEBULOSUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 360.
San Diego, California.

CALLIOSTOMA CANALICULATUM TRANSLIRATUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 360.—TRYON, Man., vol. 11, pl. 67, fig. 49.
Sitka Sound, Alaska.

CALLIOSTOMA VARIEGATUM Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 61; Proc. U. S. Nat. Mus., vol. 24, p. 552, pl. 39, fig. 10.
Puget Sound to Cerros Island.

CALLIOSTOMA PLATINUM Dall, 1889.
Proc. U. S. Nat. Mus., vol. 12, p. 343, pl. 7, fig. 2.
Farallones Islands to San Diego, California, in deep water.

CALLIOSTOMA GLORIOSUM Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 127; Proc. U. S. Nat. Mus., vol. 15, p. 201, pl. 22, fig. 5.
Twelve miles south of the Golden Gate and thence to San Diego, California.

CALLIOSTOMA ANTONII Koch, 1843.
PHILIPPI, Abb. u. Beschr., *Trochus*, p. 1, fig. 4.
Santa Barbara (Cooper) to San Diego and Panama.

CALLIOSTOMA EXIMIUM Reeve, 1842.
Proc. Zool. Soc., p. 185.—TRYON, Man., vol. 10, pl. 65, fig. 56.
Catalina Island, California, to Mazatlan, Mexico.

CALLIOSTOMA TRICOLOR Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 186; Proc. U. S. Nat. Mus., vol. 15, p. 201, pl. 19, fig. 8.
Santa Cruz to San Diego, California.

CALLIOSTOMA GEMMULATUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 653; Proc. U. S. Nat. Mus., vol. 15, p. 201, pl. 22, fig. 3.
San Pedro, California, to Gulf of California.

CALLIOSTOMA SUPRAGRANOSUM Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 653.—TRYON, Man., vol. 11, p. 369, pl. 67, fig. 71.
San Pedro to San Diego, California.

CALLIOSTOMA SPLENDENS Carpenter, 1864.

Suppl. Rep. Brit. Assoc., p. 653; Proc. U. S. Nat. Mus., vol. 15, p. 201, pl. 21, fig. 5.

Monterey to San Diego, California.

CALLIOSTOMA TURBINUM Dall, 1895.

Proc. U. S. Nat. Mus., vol. 18, p. 8; vol. 24, pl. 39, fig. 1.

Point Conception to San Diego and the islands.

Genus TURCICULA Dall, 1881.

TURCICULA BAIRDII Dall, 1889.

Bull. Mus. Comp. Zool., vol. 18, p. 377; Proc. U. S. Nat. Mus., vol. 12, p. 346, pl. 7, fig. 3.

Bering Sea, northwest of Unimak Island, in 27 fathoms; (U. S. Bureau of Fisheries). Coast of Washington to Coronado Islands, in 238 to 822 fathoms.

Genus TURCICA A. Adams, 1854.

TURCICA CAFFEA Gabb, 1865.

Proc. Cal. Acad. Sci., vol. 3, p. 187; Pal. Cal., vol. 2, p. 16, pl. 3, fig. 27.

San Pedro, California, to Cape San Lucas.

Genus CIDARINA Dall, 1902.

CIDARINA CIDARIS A. Adams, 1864.

Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 426; Proc. U. S. Nat. Mus., vol. 12, pl. 2, fig. 6.

Kasaän Bay, Alaska, to Cape San Quentin, Lower California.

Section SOLARICIDA Dall, 1902.

CIDARINA CARLOTTA Dall, 1902. (Plate 18, fig. 4.)

Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 553.

Queen Charlotte Islands, British Columbia.

CIDARINA CERATOPHORA Dall, 1895.

Proc. U. S. Nat. Mus., vol. 18, p. 9; Bull. Mus. Comp. Zool. vol. 43, p. 350, pl. 3, fig. 2.

San Diego, California, to Mazatlan, Mexico, in deep water.

CIDARINA EQUATORIALIS Dall, 1908.

Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 351, pl. 5, fig. 11.

San Diego, California, to Ecuador, in deep water.

Genus SOLARIELLA S. Wood, 1842.

SOLARIELLA PERAMABILIS Carpenter, 1864. (Plate 17, fig. 8.)

Suppl. Rep. Brit. Assoc., p. 653.—Tryon, Man., vol. 11, p. 312, pl. 67, figs. 59–61.

Forrester Island, Alaska, to San Diego and the Coronado Islands. Also Japan.

SOLARIELLA TRIPLOSTEPHANUS Dall, 1910. (Plate 18, figs. 1, 2.)

Nautilus, vol. 24, No. 3, p. 34.

Off San Diego, California, and south to Panama, in deep water.

SOLARIELLA RHYSSA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 360.
Catalina Channel, California.

? SOLARIELLA NUDA Dall, 1896.
Proc. U. S. Nat. Mus., vol. 18, p. 9; Bull. Mus. Comp. Zool., vol. 43, pl. 3, figs. 5, 7.
Monterey, California, to Clarion Island, in deep water.

Subgenus MACHAEROPLAX Friele, 1877.

MACHAEROPLAX VARICOSUS Mighels and Adams, 1842.
Boston Journ. Nat. Hist., vol. 4, p. 46, pl. 4, fig. 14.
Arctic Ocean to San Diego, California. Also Atlantic.

MACHAEROPLAX OBSCURUS Couthouy, 1838. **(Plate 18, figs. 11, 12.)**
Boston Journ. Nat. Hist., vol. 2, p. 100, pl. 3, fig. 2.
Arctic Ocean to the Fuca Strait. Circumboreal.

MACHAEROPLAX PAUPERCULUS Dall, 1919. **(Plate 18, fig. 15.)**
Proc. U. S. Nat. Mus., vol. 56, p. 363.
Arctic Ocean to the Aleutian Islands.

Genus MARGARITES Leach, 1847.

Subgenus PUPILLARIA Dall, 1909.

PUPILLARIA PUPILLA Gould, 1849. **(Plate 17, figs. 2, 10.)**
Proc. Boston Soc. Nat. Hist., vol. 3, p. 91; Rep. U. S. Expl. Exp., Moll., fig. 208.
Nunivak Island, Bering Sea, to San Pedro, California. ? San Diego, in deep water.

PUPILLARIA SORDIDA Hancock, 1846. **(Plate 17, figs. 11, 12.)**
Ann. Mag. Nat. Hist., vol. 18, p. 324.
Arctic coast, Bering Strait and the Okhotsk Sea. ? North Japan. Circumboreal.

PUPILLARIA CINEREA Couthouy, 1838.
Boston Soc. Journ. Nat. Hist., vol. 2, p. 99, pl. 3, fig. 9.
Bering Strait to Port Etches, Alaska. Circumboreal.

PUPILLARIA VORTICIFERA Dall, 1873.
Proc. Cal. Acad. Sci., vol. 5, p. 59, pl. 2, fig. 4.
Bering Strait and Sea, south and east to Unalaska, Alaska.

PUPILLARIA VORTICIFERA ECARINATA Dall, 1919.
Sci. Results Canadian Arctic Exp., vol. 8, p. 22 A, pl. 2, fig. 5.
Southwest of Point Barrow, Arctic Ocean, and south and east to the Aleutians.

PUPILLARIA VORTICIFERA SHARPII Pilsbry, 1898.
Proc. Acad. Nat. Sci. Phila., p. 486.
Unalaska to Port Althorp, Alaska.

PUPILLARIA SALMONEA Carpenter, 1864. **(Plate 18, figs. 6, 9.)**
Suppl. Rep. Brit. Assoc., p. 653; Proc. Cal., Acad. Sci., vol. 3, p. 158, Monterey, California.

PUPILLARIA RHODIA Dall, 1920. (Plate 17, fig. 4.)
CARPENTER, Proc. Acad. Nat. Sci. Phila., 1865, p. 62 (as *inflata*).
Port Althorp, Alaska, to San Diego, California.

PUPILLARIA HEALYI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 368.
Arctic Ocean north of Bering Strait (Captain Healy).

PUPILLARIA SIMBLA Dall, 1913. (Plate 18, fig. 3.)
Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 592.
Off Santa Barbara Islands, California, 534 fathoms.

? PUPILLARIA RUDIS Dall, 1919. (Plate 18, figs. 13, 14.)
Proc. U. S. Nat. Mus., vol. 56, p. 364.
Bering Sea to Cook's Inlet, Alaska. Also Kamchatka.

Subgenus LIRULARIA Dall, 1909.

LIRULARIA SUCCINCTA Carpenter, 1864. (Plate 17, fig. 9.)
Suppl. Rep. Brit. Assoc., p. 653; Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 424.
Sitka, Alaska, to San Diego, California.

LIRULARIA FUNICULATA Carpenter, 1864. (Plate 18, fig. 10.)
Suppl. Rep. Brit. Assoc., p. 653; Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 425.
Neah Bay, Washington.

LIRULARIA OPTABILIS Carpenter, 1864. (Plate 17, fig. 7.)
Suppl Rep. Brit. Assoc., p. 653; Proc. Cal. Acad. Sci., vol. 3, p. 214.
Santa Barbara to San Pedro, California.

LIRULARIA OPTABILIS KNECHTI Arnold, 1903.
Pal. San Pedro, p. 332, pl. 5, fig. 4.
Pleistocene, San Pedro, California.

LIRULARIA OPTABILIS NODOSA Arnold, 1903.
Pal. San Pedro, p. 332, pl. 5, fig. 13.
Pleistocene, San Pedro, California.

LIRULARIA LACUNATA, Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 653; Ann Mag. Nat. Hist., ser. 3, vol. 14, p. 425.
Neah Bay, Washington, to San Diego, California.

LIRULARIA PARCIPICTA Carpenter, 1864. (Plate 17, fig. 3.)
Suppl. Rep. Brit. Assoc., p. 653; Proc. Cal. Acad. Sci., vol. 3, p. 157.
Sitka, Alaska, to San Diego, California.

LIRULARIA PARCIPICTA PEDROANA Arnold, 1903.
Pal. San Pedro, p. 333, pl. 5, fig. 16.
Pleistocene, San Pedro, California.

LIRULARIA INFLATULA Dall, 1920.
CARPENTER, Suppl. Rep. Brit. Assoc., p. 653, No. 300 (as *inflata*), 1864.
Puget Sound and Neah Bay.

LIRULARIA LIRULATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 653; Proc. Acad. Nat. Sci. Phila., for 1865, p. 61.
Port Etches, Alaska, to San Diego, California.

LIRULARIA LIRULATA CONICA Carpenter, 1864. (Plate 17, fig. 1.)
Suppl. Rep. Brit. Assoc., p. 653; Proc. Acad. Nat. Sci. Phila. for 1865, p. 61.
Puget Sound.

LIRULARIA LIRULATA OBSOLETA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 653; Proc. Acad. Nat. Sci. Phila. for 1865, p. 61.
Neah Bay, Washington.

LIRULARIA LIRULATA SUBELEVATA Carpenter, 1864.
Suppl. Rep. Brit. Asso., p. 653; Proc. Acad. Nat. Sci. Phila. for 1865, p. 61.
Neah Bay, Washington.

LIRULARIA ACUTICOSTATA Carpenter, 1864. (Plate 18, fig. 5.)
Suppl. Rep. Brit. Assoc., p. 653; Proc. Cal. Acad. Sci., vol. 3, p. 157.
Bodega Bay to Coronado Islands.

LIRULARIA ALTHORPENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 365.
Granite Cove, Port Althorp, Alaska.

Subgenus MARGARITES Leach, s. s.

MARGARITES HELICINUS Phipps, 1773.
Voy. N. Pole, App., p. 198; Binney's Gould's Inv. Mass., p. 281, fig. 542.
Bering Strait, all coasts of Bering Sea, and south to Catalina Island, California. Also Atlantic.

MARGARITES HELICINUS ELEVATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 366.
Baranoff Island, Alaska.

MARGARITES HELICINUS EXCAVATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 366.
Amchitka and Middleton Islands, Alaska.

MARGARITES BERINGENSIS E. A. Smith, 1899. (Plate 16, figs. 5, 6.)
Proc. Mal. Soc. London, vol. 3, p. 206, fig. 1.
Arctic Ocean, Plover Bay, Commander Islands, and Petrel Bank, Bering Sea.

MARGARITES ALBOLINEATUS E. A. Smith, 1899. (Plate 16, figs. 3, 4.)
Proc. Mal. Soc. London, vol. 3, p. 206, fig. 2.
All coasts of Bering Sea.

MARGARITES OLIVACEUS Brown, 1827.
Ill. Conch. Gt. Brit., ed. 1, p. IV, pl. 46, figs. 30–31.
St. Lawrence Island (Krause); Atka Island, Aleutians. Also Atlantic.

MARGARITES PRIBILOFFENSIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 366.
Arctic Ocean to off Pribilof Islands, Bering Sea.

MARGARITES FRIGIDUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 357.
Arctic Ocean and south to Nunivak Island, Bering Sea; and Windfall Harbor, Admiralty Island, Alaska.

MARGARITES MARGINATUS Dall, 1919. (Plate 16, figs. 1, 2.)
Proc. U. S. Nat. Mus., vol. 56, p. 367.
Arctic Ocean and Bering Sea, south to Oregon. Also Atlantic.

MARGARITES HYPOLISPUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, p. 367.
Arctic Ocean north of Bering Strait.

MARGARITES (VAHLII var.?) TENUISCULPTUS Carpenter, 1865.
Proc. Acad. Nat. Sci. Phila., p. 61.
Neah Bay and Puget Sound. (Plover Bay, Krause?)

MARGARITES UMBILICALIS Broderip and Sowerby, 1829. **(Plate 18, figs. 7, 8.)**
Mal. and Conch. Mag., vol. 1, p. 26; Conch. Ill., *Margarita*, fig. 5.
Arctic Coast. Circumboreal.

Genus MARGARITOPSIS Thiele, 1906.

MARGARITOPSIS FRIELEI Krause, 1886.
Arch. f. Naturg., vol. 51, heft 3, p. 263, pl. 16, figs. 2*a–c;* Nachr. Mal. Ges. 1906, p. 15.
Bering Strait region.

Genus GIBBULA Risso, 1826.

GIBBULA ADRIATICA (Philippi) CANFIELDI Dall, 1871.
Enum. Moll. Sicil., vol. 2, p. 153; Amer. Journ. Conch., vol. 7, p. 129; Proc. U. S. Nat. Mus., vol. 24, pl. 39, fig. 2.
Monterey (Dall); San Pedro (Johnstone); San Diego (Bryant). Also Pleistocene and Mediterranean.

Family VITRINELLIDAE.

Genus VITRINELLA C. B. Adams, 1850.

VITRINELLA WILLIAMSONI Dall, 1892.
Proc. U. S. Nat. Mus., vol. 15, p. 202, pl. 21, figs. 2, 3.
San Pedro, California.

VITRINELLA OLDROYDI Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, No. 1520, p. 167, fig. 1.
San Pedro, California, to Point Abreojos, Lower California.

VITRINELLA ESHNAURI Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, No. 1520, p. 168, fig. 2.
San Pedro, California.

VITRINELLA ALASKENSIS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 168, fig. 3.
Unalaska, Aleutian Islands.

Section DOCOMPHALA Bartsch, 1907.

VITRINELLA STEARNSII Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 169, fig. 4.
Monterey, California.

VITRINELLA BERRYI Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 170, fig. 5.
Monterey to San Diego, California.

Genus CYCLOSTREMA Marryatt, 1818.

CYCLOSTREMA DIEGENSIS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 172, fig. 7.
San Diego, California.

CYCLOSTREMA MIRANDA Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 230, pl. 39. figs. 1-3.
San Pedro, California.

CYCLOSTREMA BALDRIDGAE Bartsch, 1911.
Proc. U. S. Nat. Mus., vol. 39, p. 229, pl. 39, figs. 7-9.
San Pedro, California, to Gulf of California.

Genus CIRCULUS Jeffreys, 1865.

? CIRCULUS ROSSELLINUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 368.
San Diego, California.

CIRCULUS COSMIUS Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 173, fig. 8.
Catalina Island, California, to Panama.

Genus CYCLOSTREMELLA Bush, 1897.

CYCLOSTREMELLA CALIFORNICA Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 174, fig. 10.
San Pedro to San Diego, California. Pleistocene.

CYCLOSTREMELLA CONCORDIA Bartsch, 1920.
Journ. Wash. Acad. Sci., vol. 10, 1920.
Olga, Washington.

Genus SCISSILABRA Bartsch, 1907.

SCISSILABRA DALLI Bartsch, 1907.
Proc. U. S. Nat. Mus., vol. 32, p. 176, fig. 11.
Monterey, California, to Gulf of California.

Genus LEPTOGYRA Bush, 1897.

LEPTOGYRA ALASKANA Bartsch, 1910.
Nautilus, vol. 23, No. 11, p. 136, pl. 11, figs. 4-6.
Port Graham, Cooks Inlet, Alaska.

Genus TEINOSTOMA A. Adams, 1854.

TEINOSTOMA SUPRAVALLATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 652; Proc. Cal. Acad. Sci., vol. 3, p. 215.
Monterey to the Gulf of California.

TEINOSTOMA INVALLATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 652; Proc. Cal. Acad. Sci., vol. 3, p. 215.
Monterey to Gulf of California.

Section PSEUDOROTELLA Fischer, 1857.

TEINOSTOMA SAPIELLA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 369.
San Pedro to San Diego, California.

TEINOSTOMA BIBBIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 369.
San Diego, California.

TEINOSTOMA (fragment).
South Coronado Island.

TEINOSTOMA SALVANIA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 369.
South Coronado Island.

Superfamily ZYGOBRANCHIA.

Family SCISSURELLIDAE.

Genus SCISSURELLA Orbigny, 1823.

SCISSURELLA KELSEYI Dall, 1905.
Nautilus, vol. 18, No. 11, p. 124.
Queen Charlotte Islands, British Columbia, to South Coronado Island.

SCISSURELLA CHIRICOVA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, no. 2295, p. 370.
Off Chirikoff Island, Alaska, in 695 fathoms.

Genus SCHISMOPE Jeffreys, 1856.

SCHISMOPE RIMULOIDES Carpenter, 1865.
Proc. Zool. Soc., p. 271.
South Coronado Island, to Mazatlan, Mexico.

SCHISMOPE CORONATA Watson, 1886.
Challenger, Rep. Gastropoda, p. 114, pl. 8, fig. 4.
Venice to San Diego, California. Also Tahiti.

? SCHISMOPE CALIANA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 56, No. 2295, p. 370.
San Diego, California.

Family HALIOTIDAE.

Genus HALIOTIS Linnaeus, 1758.

HALIOTIS CRACHERODII Leach, 1817.
Zool. Misc., p. 131; Conch. Icon., *Haliotis*, fig. 23.
Coos Bay, Oregon, to Santa Rosalia, Lower California.

HALIOTIS CRACHERODII HOLZNERI Hemphill, 1907. (Plate 20.)
Trans. San Diego Soc., Nat Hist., vol. 1, No. 2, p. 4.
San Pedro, California, to Lower California.

HALIOTIS CRACHERODII SPLENDIDULA Williamson, 1892.
Proc. U. S. Nat. Mus., vol. 15, p. 198.
Point Vincent, California.

HALIOTIS CRACHERODII IMPERFORATA Dall, 1919. (Plate 21.)
Proc. U. S. Nat. Mus., vol. 56, p. 370.
Santa Barbara Islands, California.

HALIOTIS CALIFORNIENSIS Swainson, 1822.
Zool. Illustr., vol. 2, pl. 80.—REEVE, Conch. Icon., *Haliotis*, pl. 8, fig. 26.
On the Islands; the Farallones to Guadelupe Island.

HALIOTIS CALIFORNIENSIS BONITA Orcutt, 1900.
West Amer. Scientist, vol. 10, No. 5, p. 30.
Santa Barbara to Lower California and Guadelupe Island. Mexico? (Orcutt).

HALIOTIS RUFESCENS Swainson, 1822.
Bligh Cat. Appendix, p. 2; Conch. Icon., *Haliotis*, fig. 6.
Bodega Bay, California, south to La Paz, Lower California (Rich).

HALIOTIS FULGENS Philippi, 1845.
Zeitschr. f. Mal., p. 150; Conch. Icon., *Haliotis*, fig. 9.
Farallones Islands (P. P. C.) and Catalina Island, California, to Gulf of California.

HALIOTIS WALLALENSIS Stearns, 1899. (Plate 22.)
Proc. U. S. Nat. Mus., vol. 22, No. 1191, p. 140.
Mendocino County, California.

HALIOTIS KAMTSCHATKANA Jonas, 1845. (Plate 19.)
Zeitschr. f. Mal., p. 168; Conch. Icon., *Haliotis*, pl. 3, fig. 8.
Kamchatka Sea (Midd.) Sitka, Alaska, to Redondo, California, and Sendai, Japan.

HALIOTIS CORRUGATA Gray, 1828.
WOOD, Index Test. Suppl., pl. 8, fig. 6.
Monterey, California, to San Quentin Bay, Lower California.

HALIOTIS ASSIMILIS Dall, 1878.
Proc. U. S. Nat. Mus., vol. 1, p. 46.—TRYON, Man., vol. 12, pl. 22, fig. 29.
Farallones Islands to San Diego, California, in deep water.

Family FISSURELLIDAE.

Subfamily FISSURELLINAE.

Genus FISSURELLA Bruguière, 1791.

FISSURELLA VOLCANO Reeve, 1849.
Conch. Icon., *Fissurella*, fig. 2.
Crescent City, California, to Panama.

FISSURELLA VOLCANO CRUCIFERA Dall, 1908.
Proc. U. S. Nat. Mus., vol. 34, No. 1610, p. 256.
Monterey to Lower California.

Subfamily FISSURELLIDINAE.

Genus MEGATHURA Nuttall (in Pilsbry), 1891.

MEGATHURA CRENULATA Sowerby, 1825.
Tankerville Cat., App., p. VI; Conch. Illus., *Fissurella*, fig. 18.
Monterey Bay to Cerros Island, Lower California.

Genus MEGATEBENNUS Pilsbry, 1890.

MEGATEBENNUS BIMACULATUS Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 132, pl. 15, fig. 7.
Forrester Island, Alaska, to Cape San Lucas.

Genus LUCAPINELLA Pilsbry, 1890.

LUCAPINELLA CALLOMARGINATA (Carpenter MS.) Dall, 1871.
Amer. Journ. Conch., vol. 7, p. 133, pl. 15, fig. 8.
Bodega Bay, California, to Magdalena Bay, Lower California.

Subfamily EMARGINULINAE.

Genus DIADORA Gray, 1821.

DIADORA ASPERA Eschscholtz, 1833.
Zool. Atlas, pt. 5, p. 21, pl. 23, fig. 5.
Cook's Inlet, Alaska, to Magdalena Bay, Lower California.

DIADORA ASPERA DENSICLATHRATA Reeve, 1850.
Conch. Icon., *Fissurella*, fig. 64.
Monterey, California, to San Quentin Bay, Lower California, and Socoro Island.

DIADORA INAEQUALIS Sowerby, 1834.
Proc. Zool. Soc., p. 126; Conch. Illus., *Fissurella*, fig. 45.
Santa Barbara, California, to Manta, Ecuador, and the Galapagos Islands.

DIADORA MURINA (Carpenter MS.) Dall, 1885.
Proc. U. S. Nat. Mus., vol. 8, No. 34, p. 543; vol. 15, p. 197.—ARNOLD, Pal. San Pedro, p. 339.
Crescent City, California, to Magdalena Bay, Lower California.

Genus PUNCTURELLA Lowe, 1827.

PUNCTURELLA MAJOR Dall, 1891.
Proc. U. S. Nat. Mus., vol. 14, p. 189; vol. 17, p .712, pl. 26, fig. 4.
Pribilof Islands, Bering Sea, and southward to Dixon Entrance, Alaska.

PUNCTURELLA GALEATA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 159; Rep. U. S. Expl. Exp., Moll., p. 369, pl. 31, figs. 476, 477.
Unalaska, Aleutian Islands, south to Santa Rosa Island, California.

PUNCTURELLA CUCULLATA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 159; Rep. U. S. Expl. Exp., Moll. p. 368, pl. 331, fig. 475.
Kodiak Island, Alaska, to La Paz, Lower California.

PUNCTURELLA MULTISTRIATA Dall, 1914.
Nautilus, vol. 28, No. 5, p. 63.
Atka Island, Aleutians, east and south to San Diego and Cortez Bank, California.

PUNCTURELLA COOPERI Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 651; Proc. Cal. Acad. Sci., vol. 3, p. 214.
Kasaän Bay, Alaska, to Santa Rosa Island, California.

PUNCTURELLA CARYOPHYLLA Dall, 1914.
Nautilus, vol. 28, No. 5, p. 63.
Off San Diego, California, in 67 to 81 fathoms.

PUNCTURELLA LONGIFISSA Dall, 1914.
Nautilus, vol. 28, No. 5, p. 63.
Bering Island, Bering Sea.

Genus HEMITOMA Swainson, 1840.

HEMITOMA YATESII Dall, 1901.
Nautilus, vol. 14, No. 11, p. 125; Proc. U. S. Nat. Mus., vol. 24, pl. 38, figs. 1–3.
Forrester Island, Alaska, to Monterey, California. Panama?

HEMITOMA BELLA Gabb, 1865.
Proc. Cal. Acad. Sci., vol. 3, p. 188.
Santa Cruz to San Pedro, California.

HEMITOMA GOLISCHAE Dall, 1916. (Plate 5, fig. 2.)
Nautilus, vol. 30, No. 6, p. 61.
San Nicolas Island, California.

Subclass AMPHINEURA.

Order POLYPLACOPHORA.

Superfamily EOPLACOPHORA.

Family LEPIDOPLEURIDAE.

Genus LEPIDOPLEURUS Risso, 1826.

Section LEPTOCHITON Gray, 1847.

LEPIDOPLEURUS CANCELLATUS Sowerby, 1839.
Conch. Illus. Chiton, figs. 104, 105.—Pilsbry, Man., pl. 3, figs. 54–58.
Bering Strait to Sitka and Oregon. Also Atlantic.

LEPIDOPLEURUS RUGATUS Carpenter, 1892.
Pilsbry, Man., p. 11, pl. 3, figs. 67–70.
Monterey, California, to San Tomas, Lower California.

LEPIDOPLEURUS INTERNEXUS Carpenter, 1892.
Pilsbry, Man., p. 12.
Belkoffski, Alaska, to San Diego, California.

LEPIDOPLEURUS FARALLONIS Dall, 1908.
Bull. Mus. Comp. Zool., vol. 43, No. 6, p. 355.
Farallones Islands, California, to Panama, in deep water.

LEPIDOPLEURUS AMBUSTUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 499.
Santa Barbara Channel, 20 to 40 fathoms.

LEPIDOPLEURUS BELKNAPI Dall, 1878.
Proc. U. S. Nat. Mus., vol. 1, p. 1.—Pilsbry, Man., p. 7, pl. 1, figs. 18–22.
Off Aleutian Islands, 1,006 fathoms; off Luzon, Philippine Islands, 1,050 fathoms.

LEPIDOPLEURUS LYCURGUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 500.
Catalina Island, California.

LEPIDOPLEURUS OLDROYDI (Bartsch) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 500.
Monterey to Catalina Island, California.

LEPIDOPLEURUS LURIDUS Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 566.
Puget Sound, 48 fathoms; Panama, 1,270 fathoms.

LEPIDOPLEURUS ALASCENSIS Thiele, 1909.
Zoologica, vol. 22, Heft 56, p. 13, pl. 1, figs. 51–60.
"Alaska" (Thiele).

LEPIDOPLEURUS MESOGONUS Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, p. 555.
Bering Sea, 688 fathoms; Queen Charlotte Islands, British Columbia, in 1,588 fathoms.

Section XIPHIOZONA Berry, 1919.

LEPIDOPLEURUS NEXUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 650.—Pilsbry, Man., p. 11.
Catalina Island, California, to the Gulf of California.

LEPIDOPLEURUS HEATHI Berry, 1919.
Lorquinia, Jan., 1919, p. 5; Proc. Cal. Acad. Sci., ser. 4, vol. 9, p. 6, pl. 1, figs. 1, 2; pl. 2.
Off Monterey, California, in 15 fathoms (S. S. Berry).

Genus OLDROYDIA Dall, 1894.

OLDROYDIA PERCRASSA Dall, 1894.
Nautilus, vol. 8, No. 8, p. 90; Zoologica, vol. 22, Heft 56, pt. 2, p. 71, pl. 7, figs. 1–8.
Monterey, California, to San Martin Island, Lower California.

Genus HANLEYA Gray, 1857.

HANLEYA HANLEYI Bean, 1844.
Thorpe, Brit. Marine Conch., p. 263, fig. 57.—Pilsbry, Man., p. 17, pl. 3. figs. 71–79.
Plover Bay, Bering Strait, to Monterey, California. Also Atlantic.

HANLEYA HANLEYI SPICATA Berry, 1919.
Proc. Cal. Acad. Sci., ser. 4, vol. 9, No. 1, p. 8, figs. 5, 6.
Monterey, California.

Superfamily MESOPLACOPHORA.

Family LEPIDOCHITONIDAE.

Genus LEPIDOCHITONA Gray, 1821.

Section TONICELLA Carpenter, 1873.

LEPIDOCHITONA MARMOREA Fabricius, 1780.
Fauna Grönl., p. 420.—Pilsbry, Man., pl. 10, figs. 8–15.
Circumboreal. Arctic and Bering Seas; Aleutian Islands south to Forrester Island, Alaska. Also Japan.

LEPIDOCHITONA SUBMARMOREA Middendorff, 1846.
Bull. Acad. Sci. St. Petersburg, vol. 6, No. 8, p. 120; Sibirische Reise, p. 178, pl. 14, figs. 7, 10; pl. 15, figs. 7, 8.
Aleutian Islands to Puget Sound. Also the Okhotsk Sea and Japan.

LEPIDOCHITONA SITKENSIS Middendorff, 1846.
Bull. Acad. Sci. St. Petersburg, vol. 6, p. 121; Mal. Rossica, pl. 13, figs. 1, 2.
Sitka, Alaska.

LEPIDOCHITONA LINEATA Wood, 1815.
General Conch., p. 15, pl. 2, figs. 4, 5.
On the west, the Okhotsk Sea and northern Japan. On the east, from the Aleutian Islands to San Diego, California.

LEPIDOCHITONA RUBER Linnaeus, 1767.
Syst. Nat., ed. 12, p. 1107.—Pilsbry, Man., vol. 14, pl. 7, figs. 50–56; vol. 15, pl. 15, fig. 25.
Circumboreal. Arctic Ocean to Monterey, California.

LEPIDOCHITONA SACCHARINA Dall, 1878.
Proc. U. S. Nat. Mus., vol. 1, p. 2.—Pilsbry, Man., vol. 14, p. 44; vol. 15, p. 66, pl. 15, figs. 22–24.
Pribilof, Bering, and Aleutian Islands, in shallow water. San Diego, California, in 101 fathoms.

Section LEPIDOCHITONA s. s.

LEPIDOCHITONA DENTIENS Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 145; Rep. U. S. Expl. Exp. Moll., fig. 433.—Pilsbry, Man., vol. 15, pl. 15, fig. 26.
Puget Sound to Magdalena Bay, and Socorro Island.

LEPIDOCHITONA ALBA Linnaeus, 1767.
Syst. Nat., ed. 12, p. 1107.—Pilsbry, Man., vol. 14, p. 70, pl. 7, figs. 35–38.
Circumboreal. Arctic Ocean to San Diego, California.

LEPIDOCHITONA SHARPEI Pilsbry, 1896.
Nautilus, vol. 10, No. 5, p. 50.
Unalaska, Aleutian Islands.

Section BASILIOCHITON Berry, 1918.

LEPIDOCHITONA FLECTENS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 649; Proc. Acad. Nat. Sci. Phila., 1865, p. 90.—Pilsbry, Man., vol. 15, pl. 15, figs. 34–37.
Vancouver Island to San Diego, California.

LEPIDOCHITONA FLECTENS HEATHII Berry, 1911.
Proc. Acad. Nat. Sci. Phila., p. 487, pl. 40, text figs. 1–7.
Monterey to San Pedro, California.

Section CYANOPLAX Pilsbry, 1892.

LEPIDOCHITONA HARTWEGII Carpenter, 1855.
Proc. Zool. Soc., p. 231.—Pilsbry, Man., vol. 14, p. 45, pl. 14, figs. 81–85.
Forrester Island, Alaska, to the Gulf of California.

LEPIDOCHITONA HARTWEGII NUTTALLI Carpenter, 1855.
Proc. Zool. Soc., p. 231.—Pilsbry, Man., vol. 14, p. 46.
Straits of Fuca to Turtle Bay, Lower California.

LEPIDOCHITONA RAYMONDI Pilsbry, 1894.
Nautilus, vol. 8, No. 4, p. 46.
Seward, Alaska, to San Pedro, California.

LEPIDOCHITONA FACKENTHALLAE Berry, 1919.
Lorquinia, Jan. 1919, p. 5.
Pacific Grove, Monterey Bay. (S. S. Berry.)

LEPIDOCHITONA LOWEI Pilsbry, 1918.
Nautilus, vol. 31, No. 4, p. 127.
San Pedro, California.

Subgenus SPONGIORADSIA Pilsbry, 1893.

SPONGIORADSIA ALEUTICA Dall, 1878.
Proc. U. S. Nat. Mus., vol. 1, p. 1.—Pilsbry, Man., vol. 15, p. 65, pl. 15, figs. 30–33.
Aleutian Islands.

Genus SCHIZOPLAX Dall, 1878.

SCHIZOPLAX BRANDTII Middendorff, 1846.
Bull. Acad. Sci. St. Petersburg, vol. 6, p. 117.—Pilsbry, Man., vol. 14, pl. 11, figs. 32–37.
Shantar Bay, Okhotsk Sea; Bering, Pribilof, and Aleutian Islands, and south to Cape Fox, Alaska.

SCHIZOPLAX MULTICOLOR Dall, 1920.
Nautilus, vol. 34, No. 1, July, 1920, p. 22.
Bering Sea.

Genus NUTTALLINA Carpenter, 1873.

NUTTALLINA CALIFORNICA Reeve, 1847.
Reeve, Conch. Icon., *Chiton*, pl. 16, fig. 89.—Pilsbry, Man., vol. 14, pl. 54, figs. 23, 24; pl. 56, figs. 12–18.
Straits of Fuca to San Diego, California.

NUTTALLINA FLUXA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 649.—Pilsbry, Man., vol. 14, pl. 54, figs. 21, 22; pl. 56, figs. 19, 20.
Point Conception, California, to Gulf of California.

NUTTALLINA THOMASI Pilsbry, 1898.
Proc. Acad. Nat. Sci. Phila., p. 289.
Monterey, California.

Family ISCHNOCHITONIDAE.

Genus ISCHNOCHITON Gray, 1847.

Subgenus Stenoplax, Carpenter, 1878.

STENOPLAX FALLAX Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 59, pl. 16, figs. 17–18.
Vancouver Island to Todos Santos Bay, Lower California.

STENOPLAX BIARCUATA Dall, 1903.
Proc. Biol. Soc. Wash., vol. 16, p. 176.
Santa Barbara to San Diego, California.

Section STENORADSIA Carpenter, 1878.

STENOPLAX ACRIOR Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 61, pl. 14, figs. 86–89.
San Miguel Island, California, to Gulf of California.

STENOPLAX MAGDALENENSIS Hinds, 1843.
Zool. *Sulphur's* Voy. Moll., p. 54, pl. 19, fig. 1.
Coos Bay, Oregon, to Magdalena Bay, Lower California.

STENOPLAX CONSPICUA Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 63, pl. 15, figs. 91–96.
Monterey, California, to Gulf of California.

STENOPLAX SARCOSA Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 558.
San Pedro, California, to Gulf of California.

Subgenus Ischnochiton s. s.

ISCHNOCHITON MARMORATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 503.
Pacific Grove, Monterey Bay, California.

ISCHNOCHITON BRYANTI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 503.
"California" (Bryant).

ISCHNOCHITON BRUNNEUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 504.
San Diego, California.

ISCHNOCHITON LISTRUM Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 504.
San Diego, California.

ISCHNOCHITON RITTERI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 505.
Juneau Channel, Alaska.

ISCHNOCHITON RETIPOROSUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 649.—Pilsbry, Man., vol. 15, p. 77; pl. 16, figs. 47, 50–53.
Victoria, British Columbia, to San Pedro, California.

ISCHNOCHITON RETIPOROSUS PUNCTATUS Whiteaves, 1886.
Trans. Roy. Soc. Canada, vol. 4, pt. 4, p. 125, figs.
Duncan Bay, British Columbia.

ISCHNOCHITON VENEZIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 509.
Venice, Los Angeles County, California.

ISCHNOCHITON SCROBICULATUS Middendorff, 1847.
Mal. Rossica, vol. 1 p. 127, pl. 14, figs. 4–7.—Pilsbry, Man., vol. 14, p. 76, pl. 8, figs. 66–68.
Bodega Bay, California.

ISCHNOCHITON LIVIDUS Middendorff, 1847.
Mal. Rossica, vol. 1, p. 124, pl. 13, figs. 3, 4.—Pilsbry, Man., vol. 14, p. 76, pl. 6, figs. 22–24.
Sitka, Alaska.

ISCHNOCHITON ALASCENSIS Thiele, 1910.
Zoologica, vol. 22, Heft. 56, pt. 2, p. 79, pl. 7, figs. 58–61.
Sitka, Alaska.

ISCHNOCHITON INTERSTINCTUS Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 145; Rep. U. S. Expl. Exp., Moll., p. 315, pl. 23, fig. 423.
Aleutian Islands, to Sitka and Catalina Island, California.

ISCHNOCHITON RADIANS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 121; vol. 15, p. 75, pl. 16, figs. 48, 49.
Prince of Wales Island, Alaska, to San Pedro, California.

ISCHNOCHITON SCABRICOSTATUS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 649.—Pilsbry, Man., vol. 14, p. 121; vol. 15, p. 76, pl. 16, figs. 55, 56.
San Pedro and Catalina Island, California, to Cerros Island, Lower California.

ISCHNOCHITON AUREOTINCTUS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 123.
Catalina Island, 80 fathoms, to Cerros Island, Lower California.

ISCHNOCHITON VEREDENTIENS Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 649.—Pilsbry, Man., vol. 14, p. 122.
Point New Year to Catalina Island, California.

ISCHNOCHITON NEWCOMBI Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 120.
Catalina Island, California.

ISCHNOCHITON SERRATUS Carpenter, 1892.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 315.—Pilsbry, Man., vol. 14, p. 122; vol. 15, p. 78, pl. 16, figs. 42–46.
San Diego, California, to Gulf of California.

ISCHNOCHITON CORRUGATUS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 123.
Catalina Island, California, to Todos Santos Bay, Lower California.

ISCHNOCHITON BERRYI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 54, No. 2283, p. 507.
Monterey to San Pedro, California.

Section LEPIDOZONA Pilsbry, 1892.

ISCHNOCHITON WILLETTI Berry, 1917.
Proc. Cal. Acad. Sci., ser. 4, vol. 7, p. 236, figs. 1, 2.
Forrester Island, Alaska.

ISCHNOCHITON MERTENSII Middendorff, 1846.
Bull. Acad. Sci. St. Petersburg, vol. 6, p. 118.—Pilsbry, Man., vol. 14, p. 125, pl. 26, figs. 20–26.
Sitka, Alaska, to San Pedro, California. (Lower California?)

ISCHNOCHITON COOPERI Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 127, pl. 26, figs. 27–30.
Mendocino County, California, to Catalina Island.

ISCHNOCHITON COOPERI ACUTIOR (Carpenter MS.) Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 508.
San Diego, California, to Los Animas Bay, Lower California.

ISCHNOCHITON CLATHRATUS Reeve, 1847.
Conch. Icon., *Chiton*, pl. 18, fig. 113.—Pilsbry, Man., vol. 14, p. 128, pl. 26, figs. 31–34.
Baulinas Bay, California, to Gulf of California.

ISCHNOCHITON DECIPIENS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 123.
Catalina Island to Monterey, California.

ISCHNOCHITON SINUDENTATUS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 128.
Monterey, California.

ISCHNOCHITON ASTHENES Berry, 1919.
Proc. Cal. Acad. Sci., ser. 4, vol. 9, No. 1, pl. 8; Lorquinia, Jan. 1919, p. 7.
White's Point, San Pedro, California (S. S. Berry).

ISCHNOCHITON STEARNSII Dall, 1902.
Proc. U. S. Nat. Mus., vol. 24, No. 1264, p. 557.
Off the Farallones Islands, California, in 391 fathoms.

ISCHNOCHITON GOLISCHI Berry, 1919.
Lorquinia, Jan., 1919, p. 7.
Off Santa Monica, California, in 100 fathoms (S. S. Berry).

Section RHOMBOCHITON Berry, 1919.

ISCHNOCHITON REGULARIS Carpenter, 1855.
Proc. Zool. Soc., p. 232.—Pilsbry, Man., vol. 14, p. 142, pl. 18, figs. 41–46.
Mendocino County, California, to Monterey.

Section TRIPOPLAX Berry, 1919.

ISCHNOCHITON TRIFIDUS Carpenter, 1864.
Suppl. Rep. Brit, Assoc. p. 649.—Pilsbry, Man., vol. 14, p. 141, pl. 18, fig. 40.
Shumagin Islands, Alaska, to Puget Sound.

Genus CHAETOPLEURA Shuttleworth, 1853.

CHAETOPLEURA GEMMEA Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 31, pl. 13, figs. 69–74.
Monterey, California, to Magdalena Bay, Lower California.

CHAETOPLEURA BEANII Carpenter, 1857.
Mazatlan Cat., p. 197.—Pilsbry, Man., vol. 14, p. 32.
Unalaska, Alaska, to Mazatlan, Mexico.

CHAETOPLEURA PARALLELA Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 314.—Pilsbry, Man., vol. 14, p. 34. pl. 12, fig. 50.
San Diego, California, to Cape San Lucas, and West Colombia.

CHAETOPLEURA PRASINATA Carpenter, 1864.
Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 314.—Pilsbry, Man., vol. 14, p. 34,
San Diego, California, to Cape San Lucas.

CHAETOPLEURA LACTICA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, No. 2283, p. 509.
Catalina Harbor, California.

Section DENDROCHITON Berry, 1911.

? CHAETOPLEURA THAMNOPORA Berry, 1911.
Proc. Acad. Nat. Sci. Phila., p. 487, text figs. 1–7, pl. 40.
Resurrection Bay, Alaska, to San Martin Island, Lower California.

? CHAETOPLEURA GOTHICA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 649.—Pilsbry, Man., vol. 14, p. 74; vol. 15, p. 65, pl. 15, figs. 28, 29.
Monterey to Catalina Island, California.

Genus PALLOCHITON Dall, 1878.

PALLOCHITON LANUGINOSUS (Carpenter, MS.) Dall, 1879.
Proc. U. S. Nat. Mus., vol. 1, p. 297, pl. 3, fig. 21; vol. 4, 1882, p. 287.—Pilsbry, Man., vol. 14, p. 257, pl. 56, figs. 1–11.
San Diego, California, to San Ignacio Lagoon, Lower California.

Genus CALLISTOCHITON Carpenter, 1882.

CALLISTOCHITON PALMULATUS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 262, pl. 58, figs. 12–16.
Monterey, California, to San Marco Island, Lower California.

CALLISTOCHITON PALMULATUS MIRABILIS Pilsbry, 1892.
Man., vol. 14, p. 263, pl. 58, figs. 7–11.
San Diego, California.

CALLISTOCHITON CRASSICOSTATUS Pilsbry, 1892.
Man., vol. 14, p. 264, pl. 58, figs. 1–6.
Forrester Island, Alaska, to San Diego, California.

CALLISTOCHITON DECORATUS Carpenter, 1892.
Pilsbry, Man., vol. 14, p. 269, pl. 58, figs. 17–20.
Santa Barbara, California, to San Tomas River, Lower California.

CALLISTOCHITON DECORATUS INFORTUNATUS Pilsbry, 1892.
Pilsbry, Man., vol. 14, p. 266, pl. 59, figs. 37–42.
Monterey, California, to Ecuador.

CALLISTOCHITON DECORATUS PUNCTOCOSTATUS Pilsbry, 1896.
Nautilus, vol. 10, No. 5, p. 50.
San Pedro, California, to San Tomas River, Lower California.

CALLISTOCHITON ACINATUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 510.
San Pedro, California.

CALLISTOCHITON CELETUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 510.
San Pedro, California.

CALLISTOCHITON AEPYNOTUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 511.
Puget Sound.

CALLISTOCHITON DIEGOENSIS Thiele, 1910.
Zoologica, vol. 22, Heft. 56, pt. 2, p. 86, pl. 9, figs. 4–10.
San Diego, California.

CALLISTOCHITON CYANOSUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 511.
San Pedro, California.

CALLISTOCHITON CHTHONIUS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 511.
San Pedro, California.

CALLISTOCHITON FISHERI Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 512.
Tanaga Island, Aleutians.

Family CHITONIDAE.

Genus CHITON Linnaeus, 1758.

CHITON ALBOLINEATUS Sowerby, 1828.
Zool. Journ., vol. 4, p. 368; Zool. Beechey's Voy., p. 149, pl. 40, fig. 4.
Todos Santos Bay to Guatemala.

Genus TONICIA Gray, 1847.

TONICIA PUSTULIFERA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 516.
San Pedro, California.

Family MOPALIIDAE.

Genus MOPALIA Gray, 1847.

MOPALIA CILIATA Sowerby, 1840.
Ann. Mag. Nat. Hist., p. 289; Conch. Illustr., fig. 79.
Vancouver Island, British Columbia, to Lower California.

MOPALIA CILIATA WOSNESSENSKII Middendorff, 1847.
Bull. Acad. Sci., St. Petersburg, vol. 4, p. 119.—Pilsbry, Man., vol. 14, pl. 64, figs. 69–73.
Unalaska, Alaska, to Santa Rosa Island, California.

MOPALIA CILIATA ELEVATA Pilsbry, 1892.
Man., vol. 14, p. 300, pl. 64, figs. 82, 83.
Forrester Island, Alaska, to Puget Sound.

MOPALIA MUSCOSA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 145; Rep. U. S. Expl. Exp., Moll., p. 313, fig. 436.
Shumagin Islands, Alaska, to Rosario, Lower California.

MOPALIA MUSCOSA HINDSII Reeve, 1847.
Conch. Icon., *Chiton*, pl. 12, fig. 67 *a–b*.—Pilsbry, Man., vol. 14, pl. 62, figs. 99, 100.
Sitka, Alaska, to Gulf of California.

MOPALIA MUSCOSA PORIFERA Pilsbry, 1892.
Man., vol. 14, p. 297, pl. 62, figs. 93, 94.
Baulinas Bay, California.

MOPALIA MUSCOSA LAEVIOR Pilsbry, 1918.
Nautilus, vol. 21, No. 4, p. 126.
Olympia, Washington.

MOPALIA MUSCOSA ACUTA Carpenter, 1855.
Proc. Zool. Soc., p. 232.—Pilsbry, Man., vol. 14, p. 297, pl. 64, figs. 75–81.
Santa Barbara to San Diego, California.

MOPALIA MUSCOSA LIGNOSA Gould, 1846.
Proc. Boston Soc. Nat. Hist., vol. 2, p. 142.—Pilsbry, Man., vol. 14, p. 299, pl. 63, figs. 58–59.
Sitka, Alaska, to Magdalena Bay, Lower California.

MOPALIA MUSCOSA KENNERLYI Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 648; Proc. Acad. Nat. Sci. Phila., for 1865, p. 59.
Shumagin Islands, Alaska, to Monterey, California.

MOPALIA MUSCOSA SWANII Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 648.
Shumagin Islands, Alaska, to Monterey, California.

MOPALIA CIRRATA Berry, 1919.
Lorquinia, Jan., 1919, p. 5.
Dundas Bay, Alaska. (S. S. Berry.)

MOPALIA IMPORCATA Carpenter, 1864.
Suppl. Rep. Brit. Assoc., p. 648.—Pilsbry, Man., vol. 14, p. 301, pl. 62, fig. 98.
Forrester Island, Alaska, to San Pedro, California.

MOPALIA IMPORCATA LIONOTUS Pilsbry, 1918.
Nautilus, vol. 31, No. 4, p. 126.
San Pedro and White's Point, California.

MOPALIA EGRETTA Berry, 1919.
Proc. Cal. Acad. Sci., ser. 4, vol. 9, No. 1, p. 13, pls. 6, 7.
Forrester Island, Alaska, in 20 fathoms.

MOPALIA SINUATA Carpenter, 1864.
Suppl. Rept. Brit., Assoc., p. 648.—Pilsbry, Man., vol. 14, p. 303, pl. 62, figs. 95–97.
Forrester Island to San Francisco, California.

MOPALIA PHORMINX Berry, 1919.
Proc. Cal. Acad. Sci., ser. 4, vol. 9, No. 1, p. 10, pls. 3, 4, 5.
Off Point Pinos, California. (S. S. Berry.)

MOPALIA LOWEI Pilsbry, 1918.
Nautilus, vol. 31, No. 4, p. 125.
San Pedro, California.

MOPALIA HEATHI Pilsbry, 1898.
Proc. Acad. Nat. Sci. Phila., p. 288.
Monterey, California.

MOPALIA CHLORIS Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 513.
San Diego, California.

MOPALIA CHACEI Berry, 1919.
Lorquinia, Jan., 1919, p. 6.
La Jolla, California. (S. S. Berry.)

MOPALIA GONIURA Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 513.
Granite Cove, Port Althorp, Alaska, to Puget Sound.

MOPALIA CELETOIDES Dall, 1919.
Proc. U. S. Nat. Mus., vol. 55, p. 514.
Forrester Island, Alaska.

Genus PLACIPHORELLA Carpenter, 1878.

PLACIPHORELLA BOREALIS Pilsbry, 1892.
Man., vol. 14, p. 309, pl. 66, figs. 14–17.
Bering Sea and Island, 283 fathoms; also Kuril Islands.

PLACIPHORELLA VELATA Carpenter, 1878.
Proc. U. S. Nat. Mus., vol. 1, pp. 298, 303, 307; pl. 2, fig. 36.—Pilsbry, Man., vol. 14, p. 306, pl. 66, figs. 6–12.
Trinidad, California, to Todos Santos Bay, Lower California.

PLACIPHORELLA RUFA Berry, 1917.

Proc. Cal. Acad. Sci., ser. 4, vol. 7, p. 241, text figs. 3, 4.

Forrester Island, Alaska.

PLACIPHORELLA STIMPSONI Gould, 1859.

Proc. Boston Soc. Nat. Hist., vol. 7, p. 165.—Pilsbry, Man., vol. 14, pl. 62, figs. 84–87.

On the west from Bering Island to Hakodate, Japan. On the east and south to Cerros Island, Lower California.

PLACIPHORELLA PACIFICA Berry, 1919.

Lorquinia, Jan., 1919, p. 6.

Kansaän Bay, Alaska, 95 to 98 fathoms. (S. S. Berry.)

Family ACANTHOCHITONIDAE.

Genus ACANTHOCHITONA Gray, 1821.

ACANTHOCHITONA AVICULA Carpenter, 1866.

Proc. Cal. Acad. Sci., vol. 3, p. 211.—Pilsbry, Man., vol. 15, p. 24.

Catalina Island, California, to Gulf of California.

ACANTHOCHITONA DIEGOËNSIS Pilsbry, 1893.

Man., vol. 15, p. 25, pl. 12, figs. 52–54.

Catalina Island and Newport to San Diego, California.

Genus KATHERINA Gray, 1847.

KATHERINA TUNICATA Wood, 1815.

General Conch, p. 11, pl. 2, fig. 1.—Pilsbry, Man., vol. 15, p. 41, pl. 1, figs. 1–11.

Western and southern Bering Sea, to Cooks Inlet, Alaska, and south to Catalina Island, California.

Family CRYPTOCHITONIDAE.

Genus CRYPTOCHITON Gray, 1847.

CRYPTOCHITON STELLERI Middendorff, 1846.

Bull. Acad. Sci. St. Petersburg, vol. 6, p. 116; Mal. Rossica, vol. 1, p. 93, pl. 1–9.

On the west: Bering Island, Kamchatka, the Kuril Islands, and Okhotsk Sea, and south to Hakodate, Japan. On the east, the Aleutian Islands, Cooks Inlet and southward to San Miguel and San Nicolas Islands, California.

Genus CHLAMYDOCHITON Dall, 1878.

CHLAMYDOCHITON AMICULATUS Pallas, 1786.

Nova Acta Acad. Petrop., vol. 2, p. 235, pl. 7, figs. 26–30.

Kuril Islands and Northern Japan on the west, and to the Farallones Islands, California (Newcomb), on the east.

Genus SYMMETROGEPHYRUS (Middendorff, 1848) Chenu, 1859.

SYMMETROGEPHYRUS PALLASII Middendorff, 1846.
Bull. Acad. Sci., St. Petersburg, vol. 6, p. 117; Sibirische Reise, p. 163, pl. 13, figs. 1–9.
Arctic Ocean, Bering and Okhotsk Seas, and eastward to the Shumagin Islands, Alaska.

SYMMETROGEPHYRUS VESTITUS Broderip and Sowerby, 1829.
Zool. Journ., vol. 4, p. 368; Conch. Illustr. *Chiton*, fig. 128.
Arctic Ocean and Bering Sea south to Bering, Pribilof, and Hagmeister Islands. On the Atlantic south to Cape Cod.

Order APLACOPHORA.

Family CHAETODERMATIDAE.

Genus CHAETODERMA Lovèn.

CHAETODERMA ATTENUATUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 55, pl. 4, figs. 3, 10, pl. 25; etc.
Off Prince of Wales Island, Alaska, 50 to 200 fathoms.

CHAETODERMA MONTEREYENSE Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 61, pl. 4, figs. 4, 8, 14, 17; pl. 27; etc.
Monterey Bay, 39 to 356 fathoms.

CHAETODERMA ARGENTEUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 62, pl. 4, fig. 7; etc.
Near Naha Bay, Alaska, in 82 to 113 fathoms.

CHAETODERMA ERUDITUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 59, pl. 4, figs. 9, 11; etc.
Lynn Canal and Chatham Strait, Alaska, in 282 to 313 fathoms.

CHAETODERMA CALIFORNICUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 64, pl. 4, fig. 6; etc.
Off North Coronado Island, California, in 618 to 667 fathoms.

CHAETODERMA ROBUSTUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 68, pl. 4, fig. 5; etc.
South of Alaska Peninsula, in 483 fathoms.

CHAETODERMA SCABRUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 63, pl. 4, figs. 2, 16; etc.
Monterey Bay, in 795 to 871 fathoms.

CHAETODERMA NANULUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 66, pl. 4, figs. 1, 12; etc.
Off San Diego, California, in 260 to 284 fathoms.

Genus LIMIFOSSOR Heath, 1904.

LIMIFOSSOR TALPOIDEUS Heath, 1904.
Zool. Anz., vol. 5, p. 28; Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 69, pl. 21, figs. 7–13.
Lynn Canal and Chatham Strait, Alaska, in 282 to 313 fathoms.

LIMIFOSSOR FRATULA Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 72, pl. 2, fig. 6; etc.
Off Point Loma, California, in 120 to 284 fathoms.

Family LEPIDOMENIIDAE.

Genus NEMATOMENIA Simroth, 1893.

NEMATOMENIA PLATYPODA Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 151, pl. 1, fig. 4, etc.
Off Agattu Island, Aleutians, in 482 fathoms.

Genus HEATHIA Thiele, 1913.

HEATHIA POROSA Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 159, pl. 3, fig. 4, etc.
Off San Diego, California, in 500 to 542 fathoms.

Genus DONDERSIA Hubrecht, 1888.

DONDERSIA CALIFORNICA Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 155, pl. 3, fig. 9; etc.
Off San Diego, California, in 21 fathoms.

Family NEOMENIIDAE.

Genus PACHYMENIA Heath, 1911.

PACHYMENIA ABYSSORUM Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 72, pl. 38, fig. 11; pl. 39, figs. 1–4, etc.
Off Southern California, in 2,196 to 2,228 fathoms.

Genus ALEXANDROMENIA Heath, 1911.

ALEXANDROMENIA VALIDA Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 142, pl. 3, fig. 6, etc.
Off Southern California, in 603 to 1,350 fathoms.

Family PRONEOMENIIDAE.

Genus DORYMENIA Heath, 1911.

DORYMENIA ACUTA Heath, 1911.
Mem. Mus. Comp. Zool., vol. 45, No. 1, p. 95, pl. 3, fig. 11, etc.
Off Southern California, in 302 to 638 fathoms.

SYNONYMIC NOTES.

Acanthochites, see *Acanthochitona*.
Admete viridula, see *A. couthouyi* Jay.
Alexia, see *Phytia*.
Alvania grippiana, see *aequisculpta*.
Amicula, see *Symmetrogephyrus*.
Amphissa corrugata, see *columbiana*.
Anachis petravis, see *subturrita*.
Anachis tincta, see *Mangilia lineolata*.
Angulus obtusus, see *Oudardia buttoni*.
Anomia lampe, see *A. peruviana*.
Antiplanes smithi Arnold, not Forbes, see *A. rotula*.
Assiminea, see *Syncera*.
Astyris variegata, see *hypodra*.
Aulacofusus, section, type, *Fusus spitsbergensis* Reeve.
Avicula, see *Pteria*.
Bela, see *Lora*.
Bela schmidti, see *Lora harpa*.
Bela tenuilirata Krause, not Dall, see *Lora lawrenciana*.
Bittium barbarense, see *B. asperum*.
Bittium esuriens, see *B. attenuatum*.
Bittium filosum, see *B. eschrichtii*.
Boreotrophon, see *Neptunea*.
Boreotrophon gracilis Carpenter, see *N. multicostata* Eschscholtz.
Boreotrophon gunneri Carpenter, see *N. multicostata* Eschscholtz.
Boreotrophon lamellosus Gray, see *N. cepula*.
Boreotrophon multicostatus Arnold, see *N. pacifica*.
Boreotrophon scalariformis Carpenter, see *N. pacifica*.
Boreotrophon subserratus Sowerby, see *N. tenuisculpta* Carpenter.
Buccinum tricarinatum, see *triplostephanum*.
Bulla nebulosa Gould, see *Bullaria gouldiana* Pilsbry.
Cadulus simplex, see *C. stearnsii*.
Cerithiopsis fortior, see *Bittium interfossa*.
Cerithium incisum, see *C. sculptum*.
Cerostoma, see *Purpura*.
Chorus Carpenter, not Gray, see *Forreria*.
Chrysallida pumila Carpenter, see *Besla callimorpha*.
Chrysodomus fornicatus Gmelin, 1792, see *solutus* Hermann, 1781.
Chrysodomus heros Gray, 1850, see *solutus* Hermann, 1781.
Cithna, see *Cythna*.
Clathurella, see *Philbertia*.
Clathurella lowei, see *Philbertia crystallina*.
Cleodora, see *Clio*.
Clistaxis, see *Brocktonia*.
Closia, see *Merovia*.
Cumingia californica, see *C. lamellosa*.
Dentalium columbianum, see *pretiosum*.
Dentalium hexagonum, see *neohexagonum*.
Dentalium indianorum, see *pretiosum*.

Drillia, see *Cymatosyrinx* and *Clathrodrillia*.
Drillia inermis, see *ophioderma*.
Drillia cancellata, see *rhines*.
Eucosmia, see *Eulithidium*.
Eulima, see *Melanella*.
Euthria, see *Searlesia*.
Fissuridea, see *Diadora*.
Fusus, see *Fusinus*.
Fusus robustus Trask, see *F. monksae* Dall.
Fusus rugosus Trask, see *F. traski* Dall.
Gibbula, see also *Lirularia*.
Glyphis, see *Diadora*.
Gyrodisca, see *Megalomphalus*.
Harfordia, new section, type, *Fusus harfordi* Stearns.
Hydrobia, see *Cingula*.
Isapis, see *Iselica*.
Jeffreysia, see *Rissoella*.
Limacina, see *Spiratella*.
Limatofusus, new section, type *Aulacofusus tahwitanus* Dall.
Liostraca, see *Strombiformis*.
Littorina grandis, see *squalida*.
Lucapina, see *Megathura*.
Lunatia, see *Euspira*.
Macrochasma, see *Megathura*.
Macromphalina, see *Megalomphalus*.
Mangilia funebrale, see *M. levidensis*.
Mangilia nitens Carpenter, not Sowerby, see *pulchrior*.
Margarita, see *Margarites*.
Margarita inflata Carpenter, 1864, see *inflatula*.
Margarita inflata Carpenter, 1865, see *rhodia*.
Maugerella, see *Stenoradsia*.
Mitra nodoso-cancellata, see *M. solitaria*.
Modiolaria, see *Musculus*.
Monoceros, see *Acanthina*.
Monoceros engonatum, see *Acanthina spirata*.
Murex californica, see *erinaceoides*.
Murex incisa, see *Triremis gemma*.
Murex painei, see *Tritonalia*.
Mysella, see *Rochefortia*.
Mytilus hamatus, see *recurvus*.
Nacella, see *Rhodopetala*.
Nettastomella darwini, see *N. rostrata*.
Nitidella dalli E. A. Smith, see *gouldii* Carpenter.
Nuttallina scabra, see *N. fluxa*.
Ocinebra, see *Tritonalia*.
Odostomia tenuis, see *Evalea io*.
Oedalina, see *Cooperella*.
Olivella intorta, see *O. pedroana* Conrad.
Onchidella, see *Arctonchis*.
Opalia borealis, see *wroblewskii*.
Pachydesma crassatelloides, see *P. stultorum*.
Panomya norvegica, see *P. arctica*.
Pectunculus, see *Glycymeris*.

Phorous, see *Promartynia*.
Pinna, see *Atrina*.
Pristiphora, see *Serridens*.
Purpura Lamarck not Martyn, see *Nucella*.
Purpura crispata, see *Nucella lamellosa*.
Purpura decemcostata, see *Nucella canaliculata*.
Purpura lactuca, see *Nucella lamellosa*.
Purpura saxicola, see *Nucella emarginata*.
Pterorytis, see *Purpura*.
Retusa Brown, type *Bulla obtusa* Montagu.
Rissoa cooperi Tryon, see *Barleeia subtenuis*.
Rissoa interfossa, see *Bittium*.
Rupellaria, see *Venerupis*.
Scala and Scalaria, see *Epitonium*.
Scalaria hindsii, see *Epitonium fallaciosum*.
Scrobs, see *Amphithalamus*.
Sigaretus, see *Sinum*.
Siphonalia fuscotincta Carpenter,=*Amphissa sp.* jun.?
Skenea, see *Skeneopsis*.
Styliferina, see *Alabina*.
Stylopsis, see *Graphis*.
Subemarginula, see *Hemitoma*.
Sulcularia, new section, type, *Retusa sulcata* Orbigny (as *Bulla*).
Surculina, see *Phenacoptygma*.
Tapes, see *Protothaca*.
Tegula coronulata, see *mariana*.
Tegula fuscescens, see *ligulata*.
Terebra simplex Carpenter 1865, not Conrad, 1830, see *T. pedroana*.
Tornatina, see *Acteocina*.
Tornatina cerealis=*Acteocina culcitella* junior.
Trachydermon, see *Lepidochitona*.
Trachydermon pseudodentiens, see *L. dentiens*.
Trichotropis borealis not of Broderip and Sowerby, see *T. costellata* Couthouy.
Trochiscus, see *Norrisia*.
Trophon muricata Hinds, see *Coralliophila hindsii* Carpenter.
Trophon muriciformis, see *Neptunea dalli*.
Turritella polaris, see *T. erosus*.
Vermetus, see *Vermicularia*.
Vermetus fewkesii Yates, see *V. eburnea* junior.
Volutella, see *Merovia*.
Volvarina, see *Hyalina*.
Volvarina varia, see *Hyalina californica*.
Volvula, see *Volvulella*.

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BIBLIOGRAPHY OF WORKS REFERRED TO.

PERIODICALS.

American Journal of Conchology, vols. 1–7, Philadelphia.
American Journal of Science and Arts, New Haven.
Analyst, The, vol. 8, 1838, Worcester, England.
Annales des Sciences Naturelles, Paris, vol. 26, 1832.
Annals and Magazine of Natural History, London.
Annals of Philosophy (Thomson), London.
Archiv für Naturgeschichte (Wiegmann), 1885–6.
Canadian Naturalist, The, 1865.
Conchologist, The, vol. 2, 1893, London.
Jahrbuch der Malakozoologische Gesellschaft, 1882, Frankfurt am Main.
Journal de Conchyliologie, Paris.
Journal de Physique, 1817, 1819, Paris.
Lorquinia, 1919, Los Angeles, California.
Magazine of Natural History, new ser., vol. 2, 1838, London.
Malakozoologische Blätter, 1854–1891, Cassel.
Naturforscher, Der., vol. 16, 1788, Halle.
Nautilus, The, vol. 1–32, Philadelphia.
Nova Acta Petropolitana, vol. 2, 1788 (Pallas).
Philosophical Magazine, Edinburgh, vol. 61, 1823.
Science, vol. 4, p. 50, 1884.
West American Scientist, San Diego, California (Orcutt).
Zeitschrift für Malakozoologie, 1848, vol. 1–9, Cassel.
Zeitschrift für Wissenschaftliche Zoologie, vol. 47, 1888.
Zoë, vol. 4, 1894, San Francisco, California.
Zoologica, vol. 22, Heft 56, 1909 (Thiele).
Zoologische Jahrbuch, vol. 7, 1893; vol. 20, 1904.
Zoological Journal, London, vol. 1–5, 1824–1834.

SOCIETIES AND MUSEUMS.

Academy of Natural Sciences, Philadelphia, Journal, Proceedings.
Annals of the Lyceum of Natural History of New York, vol. 4, 1848.
Beschreibung der Gesellschaft Naturforschende Freunde zu Berlin.
Boston Journal of Natural History, vols. 1–7.
Boston Society of Natural History, Proceedings.
British Association for the Advancement of Science, Annual Reports for 1856 and 1863 (Carpenter).
California Academy of Sciences, San Francisco, Proceedings, vols. 1–7, 1854–1876; Memoirs, vol. 3, 1903 (Arnold).
Geological Survey of Canada, Reports of Progress, Memoirs.
Imperial Academy of Sciences, St. Petersburg, Bulletin, 1847–1849.
Konglige Svenska Vetenskaps Akademie, Handlinger, 1847–1878.
Linnean Society, London, Transactions.
Magasin de Zoologie (Guérin) Mollusca, 1830–1846.
Mineralogische Gesellschaft, St. Petersburg, Verh., 1848–9.

Musée d'histoire Naturelle, Paris, Bulletin, 1895; Annales, vols. 15, 16, 1810–11; Nouvelles Annales, vol. 1, 1832.

Museum of Comparative Zoology, Cambridge, Mass., Bulletins; Memoirs, vol. 14, No. 1, 1911 (Heath).

Natural History Society of British Columbia, Bulletin No. 2, 1897 (Victoria).

Norske Videnskabs Selskabet, Forh., 1868.

Revue Zoologique, Société Cuvierienne, Paris.

Royal Society of Canada, Transactions, vol. 4, section 4, 1887.

Santa Barbara (Cal.) Society of Natural History, Bulletin No. 2, 1890.

Smithsonian Institution, Miscellaneous Collections.

Société d'histoire Naturelle, Paris, Mémoires, 1799–1825.

Société Malacologique de Belgique, Mémoires, 1869.

United States Fish Commission, Bulletins.

United States National Museum, Proceedings; Bulletins.

University of California, Zoological Publications, vols. 15 and 19.

Wagner Free Institute of Science, Transactions, vol. 3, Philadelphia.

Zoological Society of London; Proceedings.

VOYAGES.

Beechey's Voyage to the Pacific and Behring's Straits, Zoology, 1839.

Belcher, Last of the Arctic Voyages, vol. 3, 1855 (Reeve).

Bonite, Voyage of the; Zoologie, Atlas, 1841.

Challenger Voyage, Reports.

Dall, Scientific Results of the Exploration of Alaska, 1876–1879.

Dixon's Voyage around the World, etc., 1789.

Friele, North Atlantic Expedition, Reports.

Gaimard, Voyage de la *Recherche*, etc. Paris, 1851 (Beck).

Gould, Mollusca and shells of the United States Exploring Expedition (under Wilkes), 1852.

Gray, Dr. J. E. Parry's First Voyage, Supplement to the Appendix, 1824.

Hinds, Zoology of the Voyage of H. M. S. *Sulphur*, vol. 2, 1844.

Humboldt and Bonpland, Observations Zoologiques, 1832.

Lesson, Voyage de la *Coquille*, Zoologie, 1830.

Orbigny, A. d'; in Sagra, Histoire de l'isle de Cuba, Mollusques, vols. 1–2, 1841–1845.

Orbigny, Voyage en Amerique Méridionale, vol. 5, 1835–1846.

Pacific Railroad Surveys, Reports, vol. 5, 1855; vol. 6, 1856.

Pallas, Spicilegia Zoologica, 1774.

Perry, Japan Expedition, Reports, vol. 2 (Jay).

Phipps, Voyage to the North Pole, 1773.

Ray, Polar Expedition to Point Barrow, Report, 1885.

Scientific Results of the Canadian Arctic Expedition, vol. 8, pt. A, 1920.

Valenciennes, Voyage de la frégate *Venus*, Atlas, 1846.

Vega Expeditionens Vetenskapliga Iakttagelser, vols. 1–4.

ICONOGRAPHIES.

Eschscholtz, Zoological Atlas, 1833.

Gray, Descriptive Catalogue of Cypraea, 1832 (Zoological Journal).

Gray, Mrs. Emma. Figures of Molluscous Animals, 1850–1857.

Haldeman, Monograph of the Freshwater Mollusca, vol. 1, 1840.

Hanley, Descriptive Catalogue of Recent Bivalve Shells, 1842–1856.

Kiener, Species général des Coquilles Vivantes, 1835–1857.
Leach, Zoological Miscellany, 1817.
Martini and Chemnitz, Conchylien Cabinet, 2d edition.
Martyn, Figures of Nondescript Shells, 1784–1786.
Novitates Conchologicae, Mollusca Marina, 1858 (Mörch).
Perry, Conchology, 1811.
Philippi, Abbildungen und Beschreibungen neue oder wenig gekannte Conchylien, vols. 1–3.
Reeve, Conchologia Systematica, vols. 1–2, 1842.
Reeve and Sowerby, Conchologia Iconica, vols. 1–20.
Sowerby, Conchological Illustrations, vols. 1–2.
Sowerby, Genera of Shells, 1821–1834.
Sowerby, Species Conchyliorum, 1830.
Sowerby, Thesaurus Conchyliorum, vols. 1–4.
Swainson, Zoological Illustrations, vol. 1, 1822.
Tryon and Pilsbry, Manual of Conchology, vols. 1–17.
Turton, Dithyra Britannica, Conchylia Insularum Britannicum, 1822.
Wood, Index Testaceologicus, 2d edition, 1825, Suppl. 1828 (Gray).

FAUNISTIC.

Adams, C. B. Panama Shells, 1852.
Arnold, Ralph. Paleontology of San Pedro, California, 1903 (Cal. Acad.).
Arnold, Ralph. Tertiary Pectens of California, 1906 (U. S. Geol. Survey).
Binney, W. G. The Terrestrial Air-breathing Mollusks of the United States, vol. 4, 1859.
Brown, Thomas. Illustrations of the Conchology of Great Britain and Ireland, ed. 1, 1827; ed. 2, 1838–1844.
Carpenter, Catalogue of the Reigen Collections of Mazatlan Mollusca, 1855–1857. (British Museum.)
Conrad, American Marine Conchology, 1831–32.
Fabricius, Fauna Grönlandica, 1776.
Forbes, Malacologia Monensis, 1838.
Forbes and Hanley, British Mollusca, vols. 1–4.
Gabb, Paleontology of California, State Geological Survey, vols. 1, 2, 1865–1869.
Gould, Mexican and Californian Shells, 1851.
Gould, Report on the Invertebrata of Massachusetts, 1841. Ed. 2, by Binney, 1870.
Jeffreys, British Conchology, vols. 1–5, 1862–1869.
Keep, West Coast Shells, San Francisco, 1911.
Linnaeus, Fauna Suecica, Ed. 2, 1761.
Lovèn, Index Molluscorum litora Scandinaviae Occidentalia habitantium, Holmiae, 1846.
Lyell, On the Rising of Sweden, 1839.
Middendorff, Beitrage zu einer Malacologia Rossica, 1847–1849.
Middendorff, Sibirische Reise, parts 1, 2; 1851.
Moller, Index Molluscorum Grönlandiae, 1842.
Montagu, Testacea Britannica, 1803, and Supplement, 1808.
Müller, Prodromus Zoologiae Danicae, 1776.
Posselt, Conspectus faunae Groenlandicae, Mollusca, Copenhagen, 1898.
Sars, G. O., Mollusca regionis arcticae Norvegiae, 1878.
Sars, M. Fossile Dyre Quaternary Periods, 1865.
Say, American Conchology, 1830–1834.

Schrenck, Reisen und Forschungen im Amurlande, 1861.
Stimpson, Shells of New England, 1851.
Thorpe, British Marine Conchology, 1844.
Whiteaves, in Ottawa Naturalist, vol. 8, new ser., 1878.

SYSTEMATIC.

Chenu, Manuel de Conchyliologie et de Paléontologie Conchyliologique, 1859–1862.
Deshayes, Catalogue of Conchifera or Bivalve shells in the British Museum, 1853–54.
Dillwyn, Descriptive Catalogue of Recent Shells, 1817.
Gmelin, Systema Naturae, vol. 7, 1791–92.
Jay, A catalogue of the shells in the collection of John C. Jay, M. D., with descriptions (etc.) 1839.
Lamarck, Animaux sans Vertebres, vols. 1–7, 1815–1822. Ed. 2 (Deshayes), Mollusques, vols. 1–5, 1835–1846.
Linnaeus, Mantissa plantarum, 1767–1771.
Mawe, The Linnean System of Conchology, 1823.
Menke, Synopsis Methodica Molluscorum * * * in Museo Menkeano, 1830.
Schumacher, Essai d' un Nouveau Système des habitations des Vers testaces, 1817.
Sowerby, A catalogue of the shells contained in the collection of the late earl of Tankerville; 1825.
Stearns, Conchological Memoranda, pts. 1–12, 1866–1873.
Swainson, A catalogue of the rare and valuable shells which formed the celebrated collection of the late Mrs. Bligh; with an appendix containing scientific descriptions of many new species, 1822.
Swainson, Zoological Illustrations, vol. 2, 1823.
Wood, General Conchology, 1815.

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Figures 1 and 3 drawn by Miss Evelyn Mitchell, the others by the late Doctor J. C. McConnell.

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All these figures drawn by Miss Evelyn Mitchell.

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All these figures drawn by the late Doctor J. C. McConnell.

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All these figures drawn by Miss Evelyn Mitchell.

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Figures 1, 3, 4, and 6, were drawn by the late Doctor J. C. McConnell, the others by Miss Evelyn Mitchell.

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Figures 1, 2, and 7 were drawn by the late Doctor J. C. McConnell; the others by Miss Evelyn Mitchell.

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All these figures drawn by Doctor J. C. McConnell.

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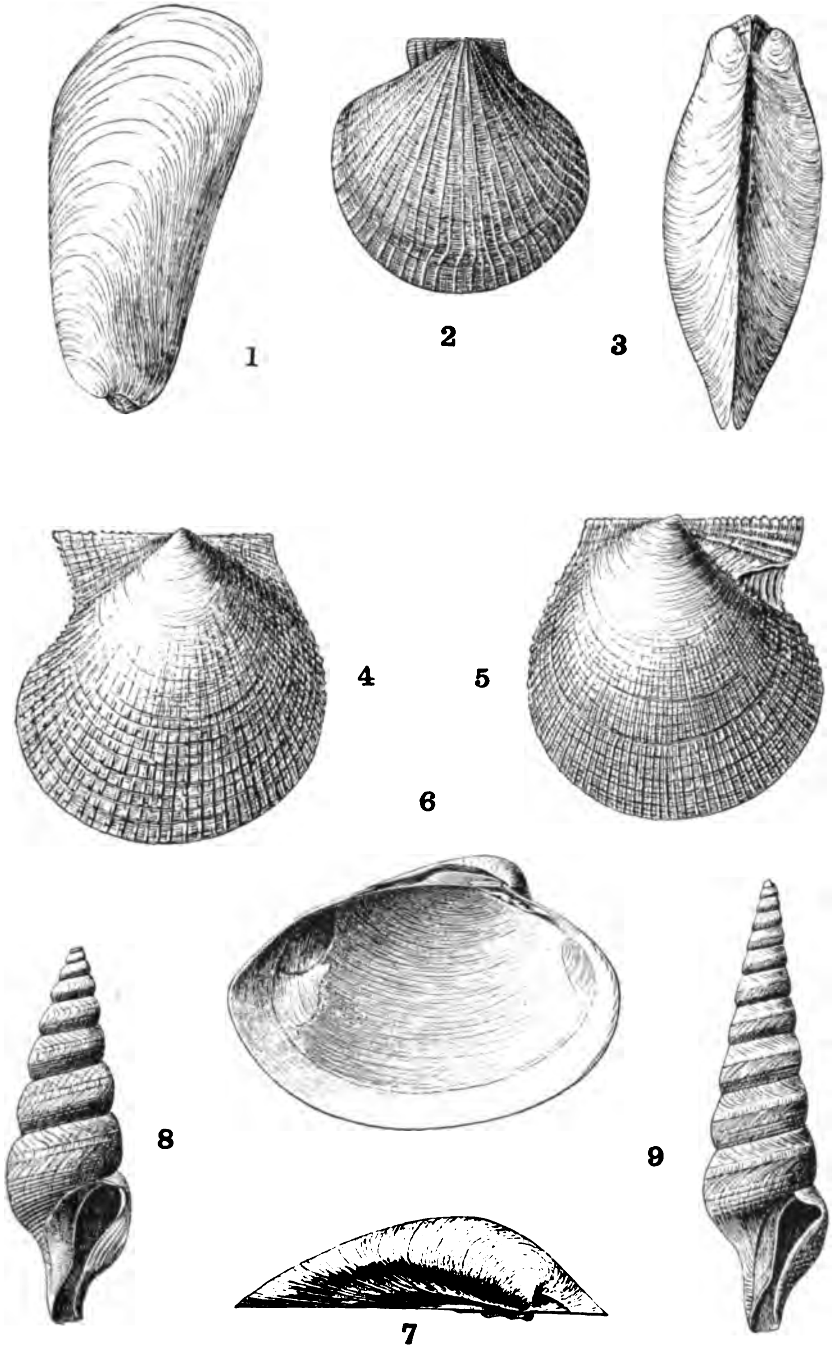

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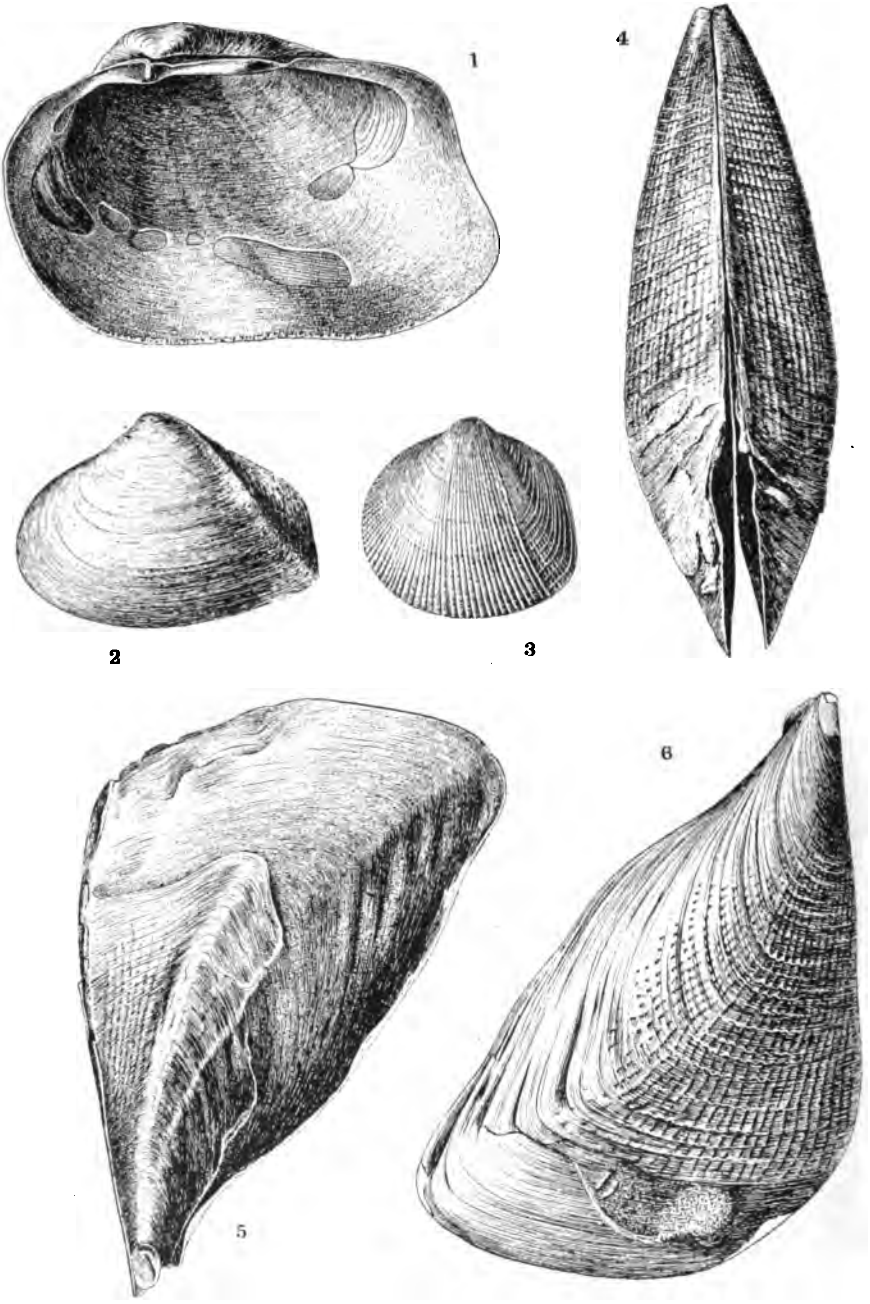

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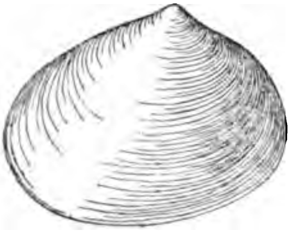
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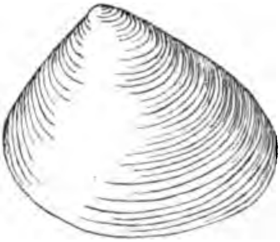
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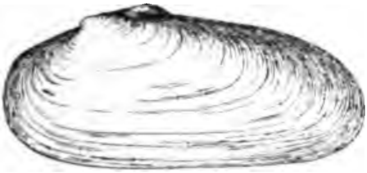

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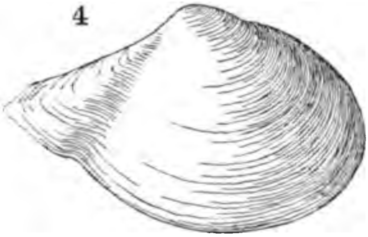

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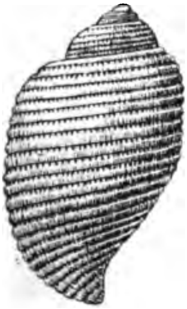

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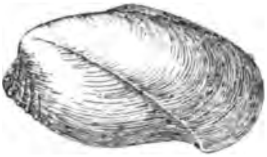

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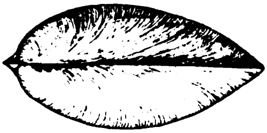

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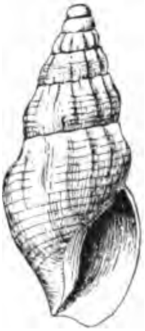

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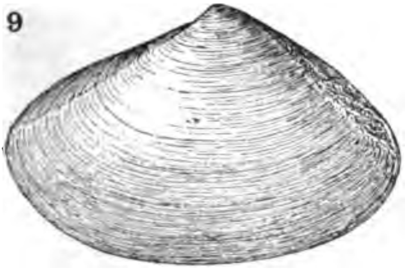

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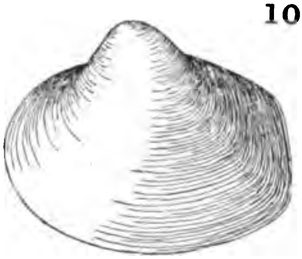

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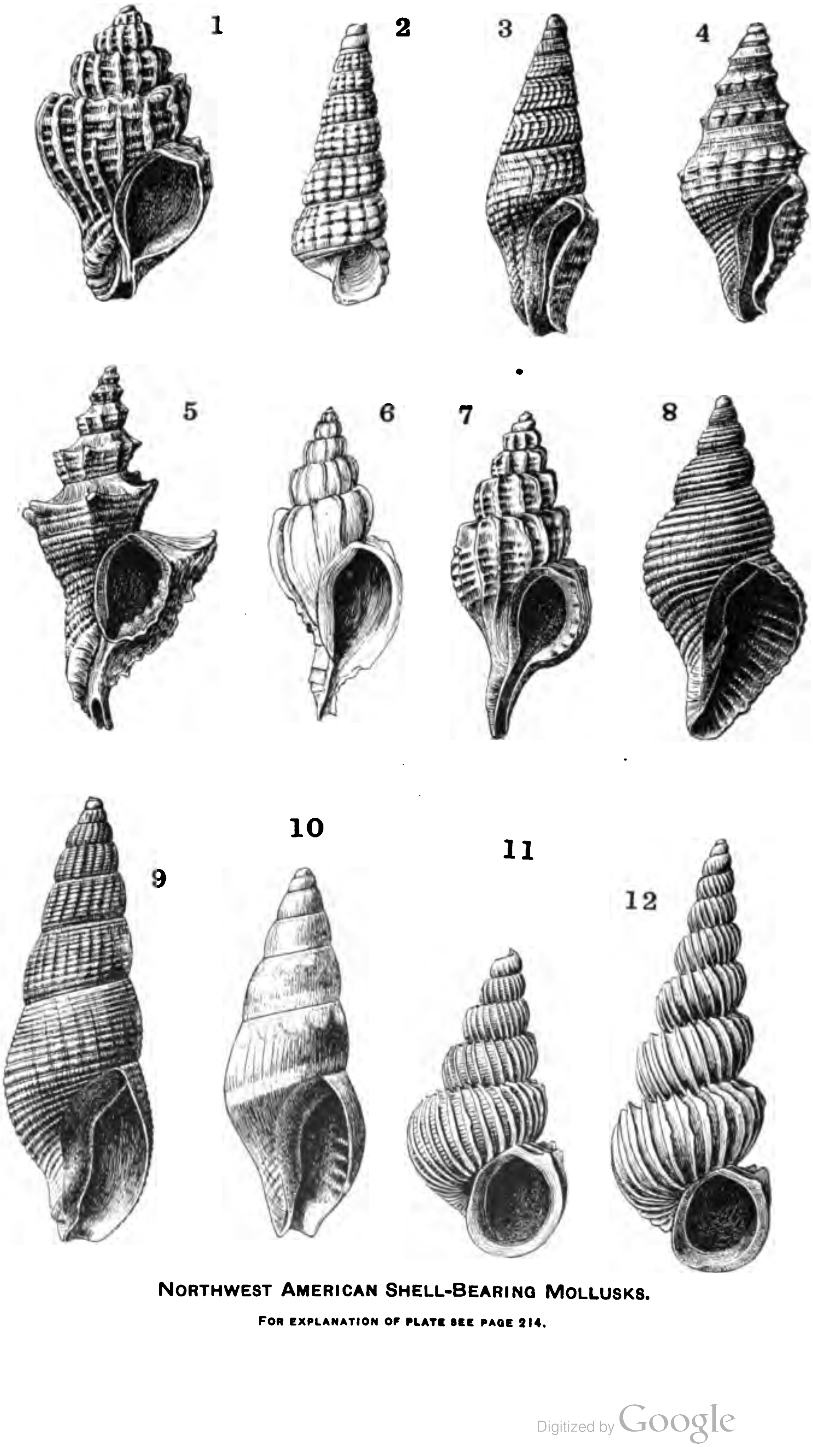

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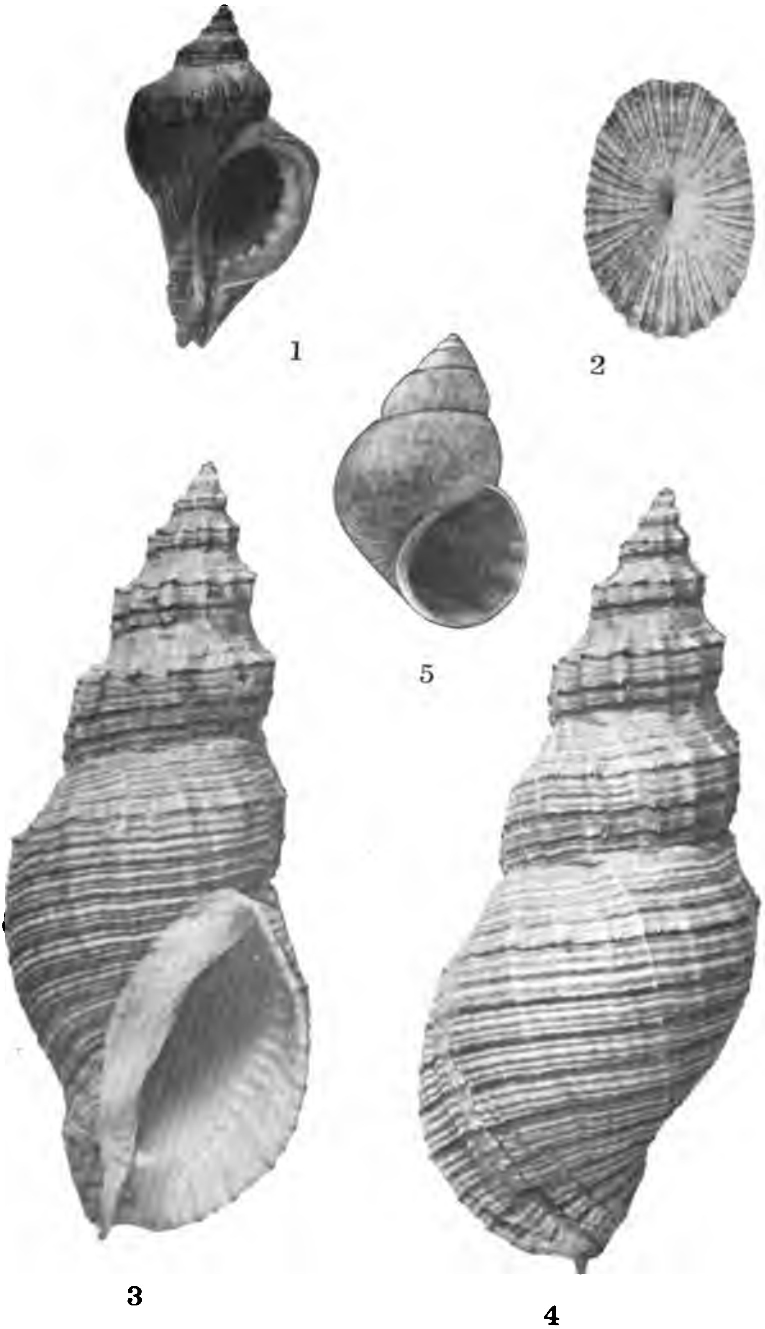

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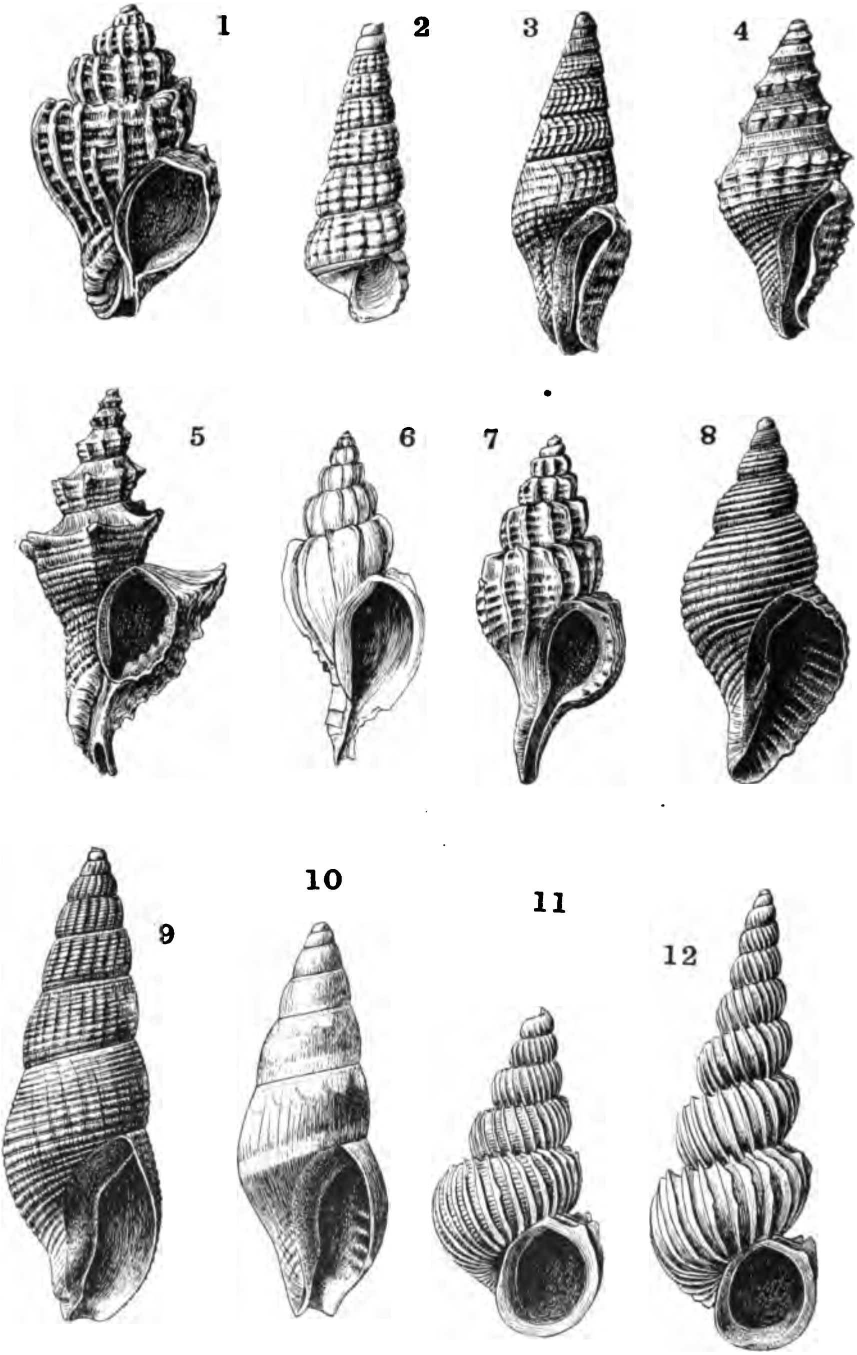

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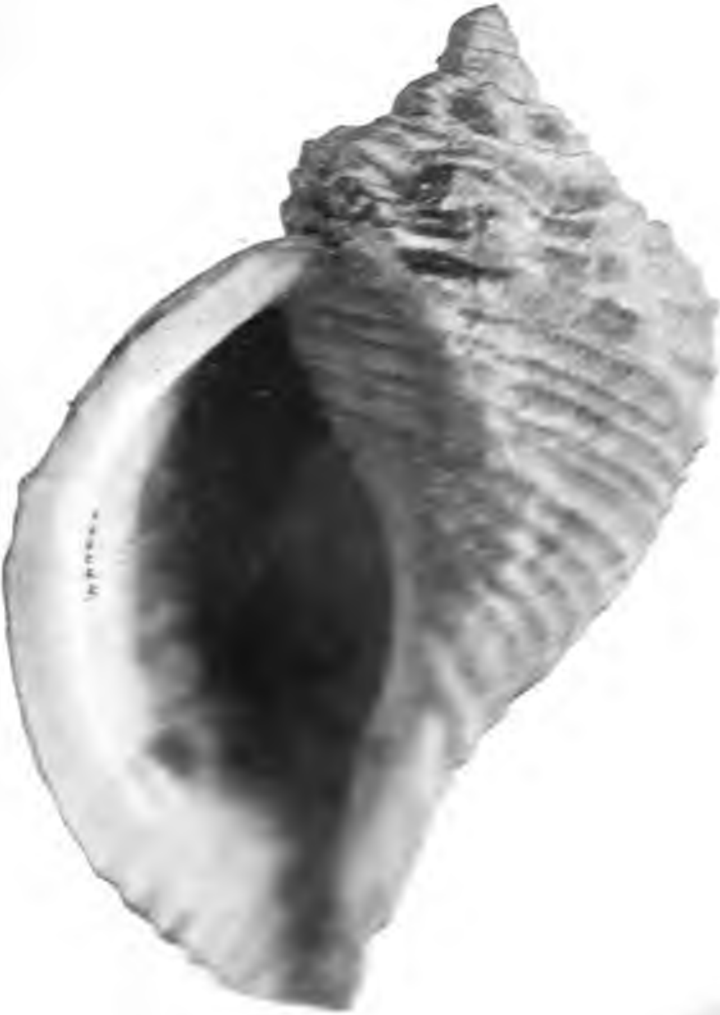

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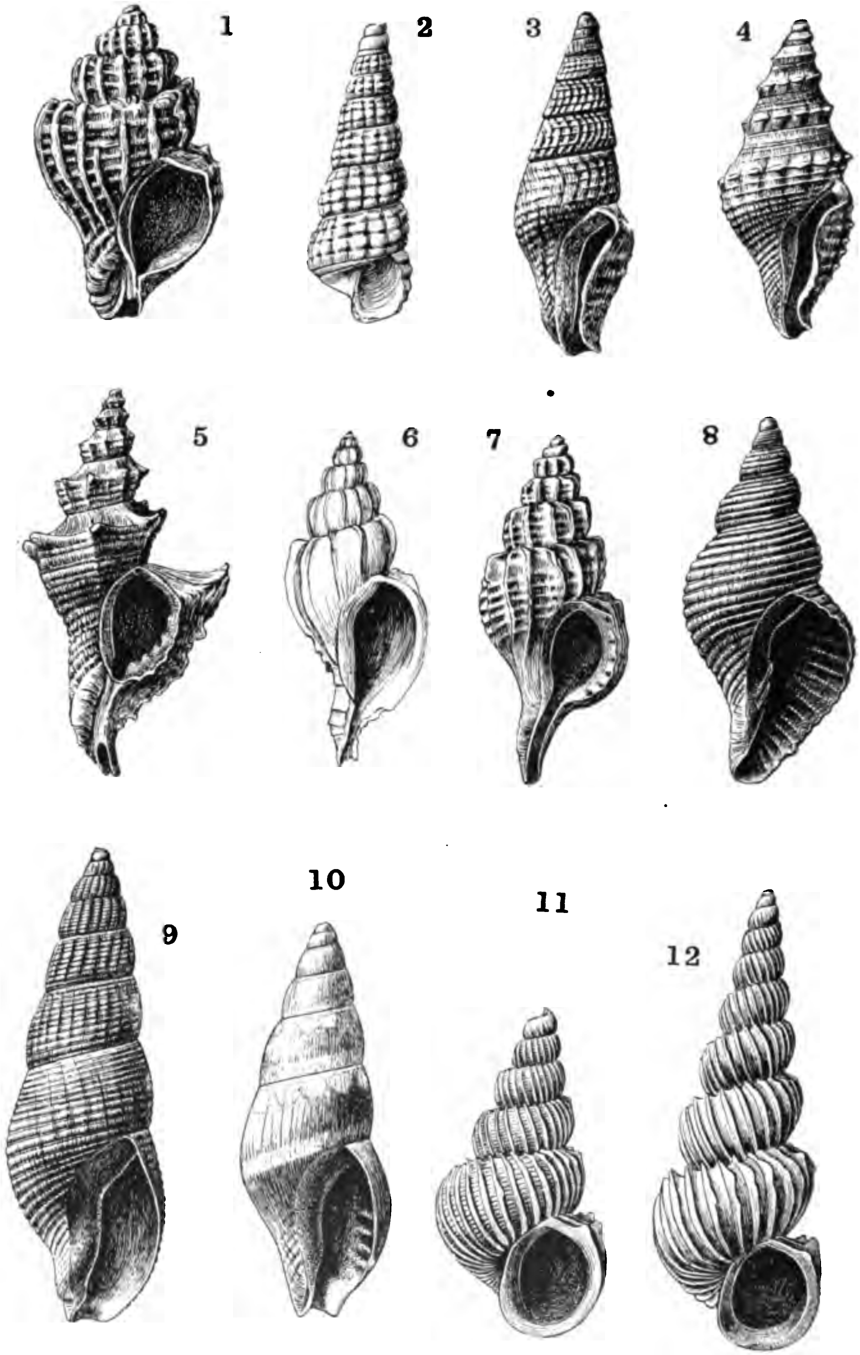

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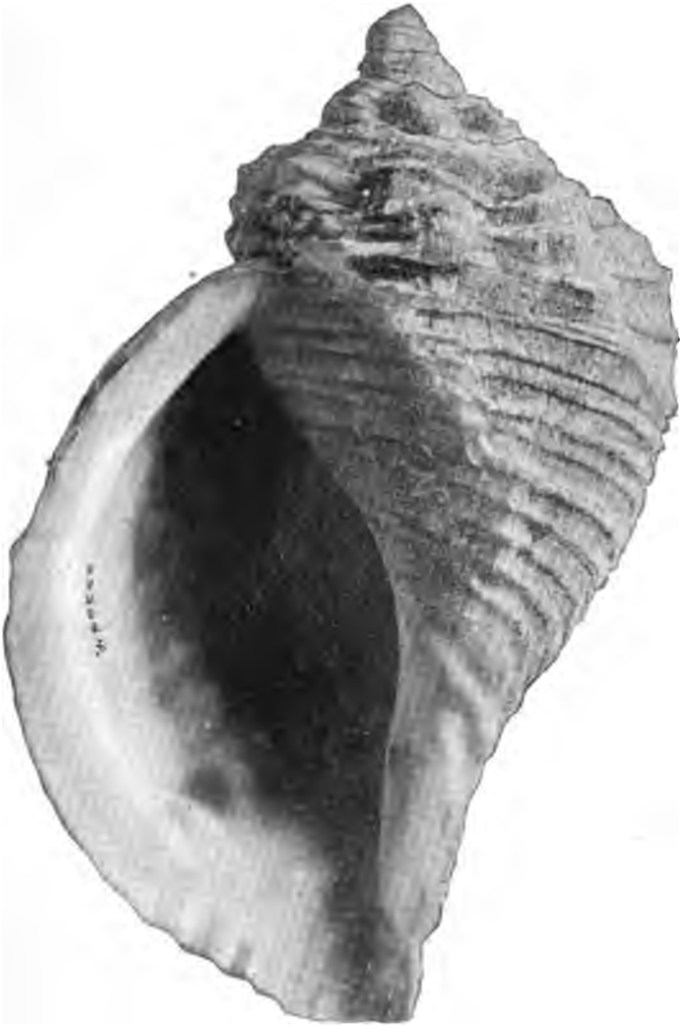

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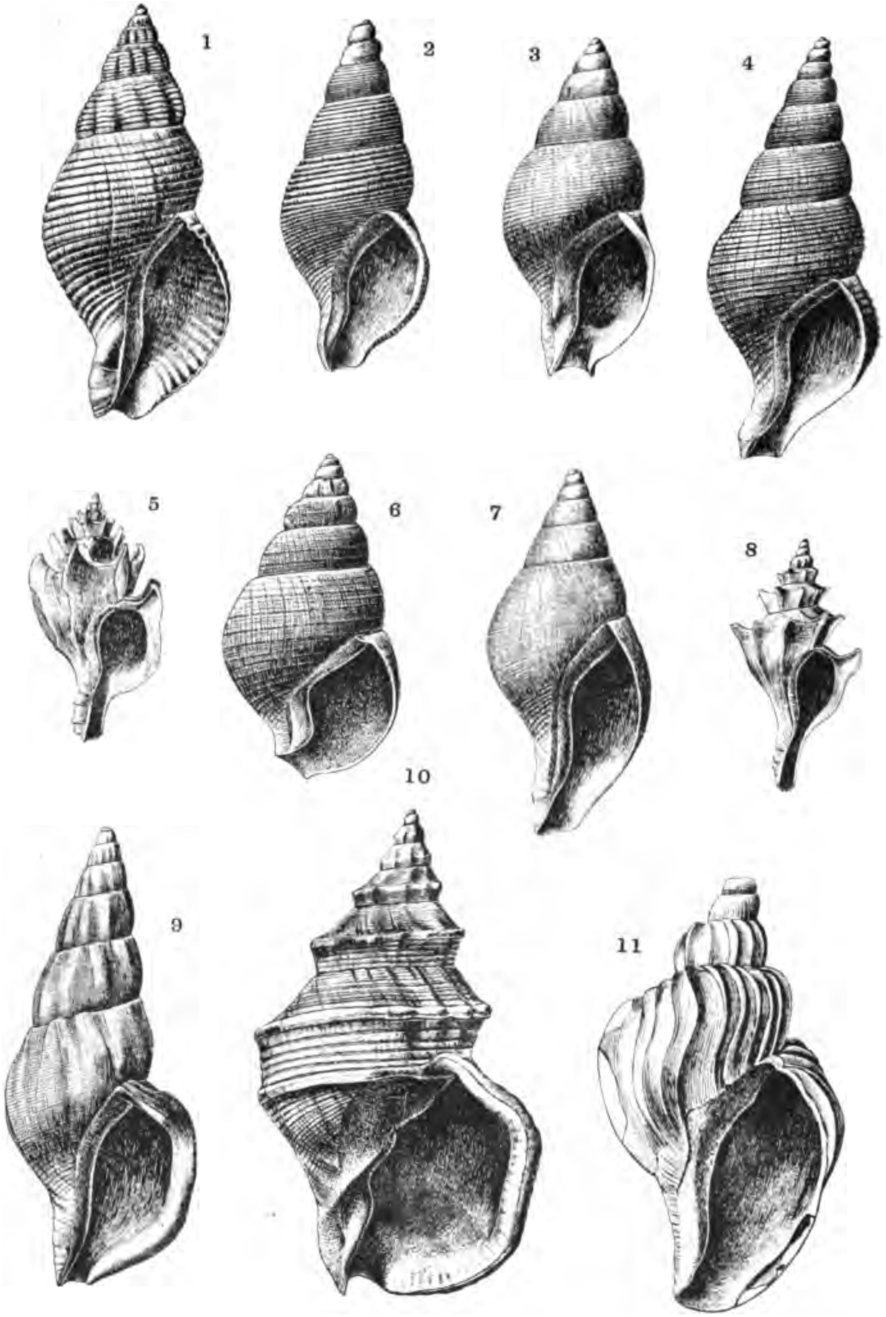
PYRULOFUSUS HARPA MÖRCH. SEE PAGE 214.



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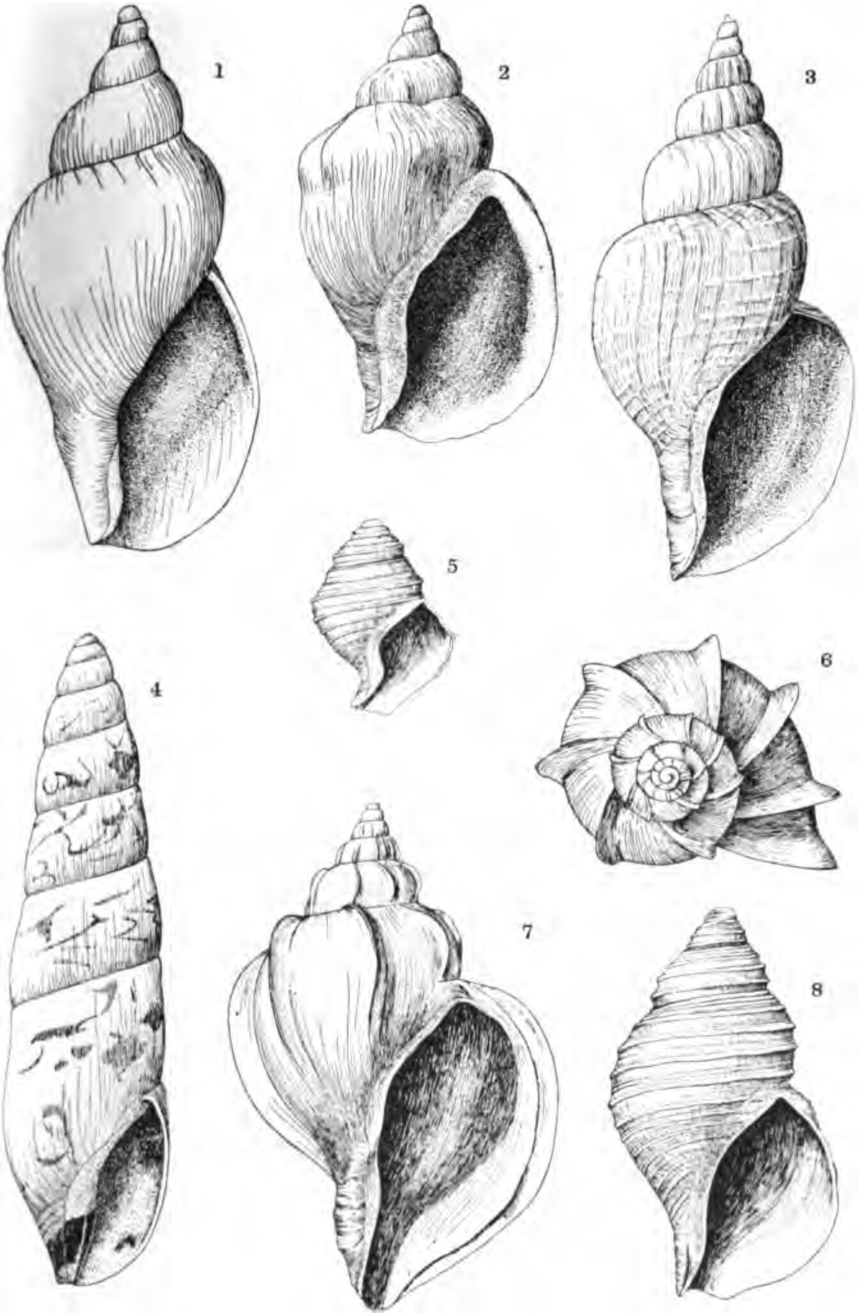

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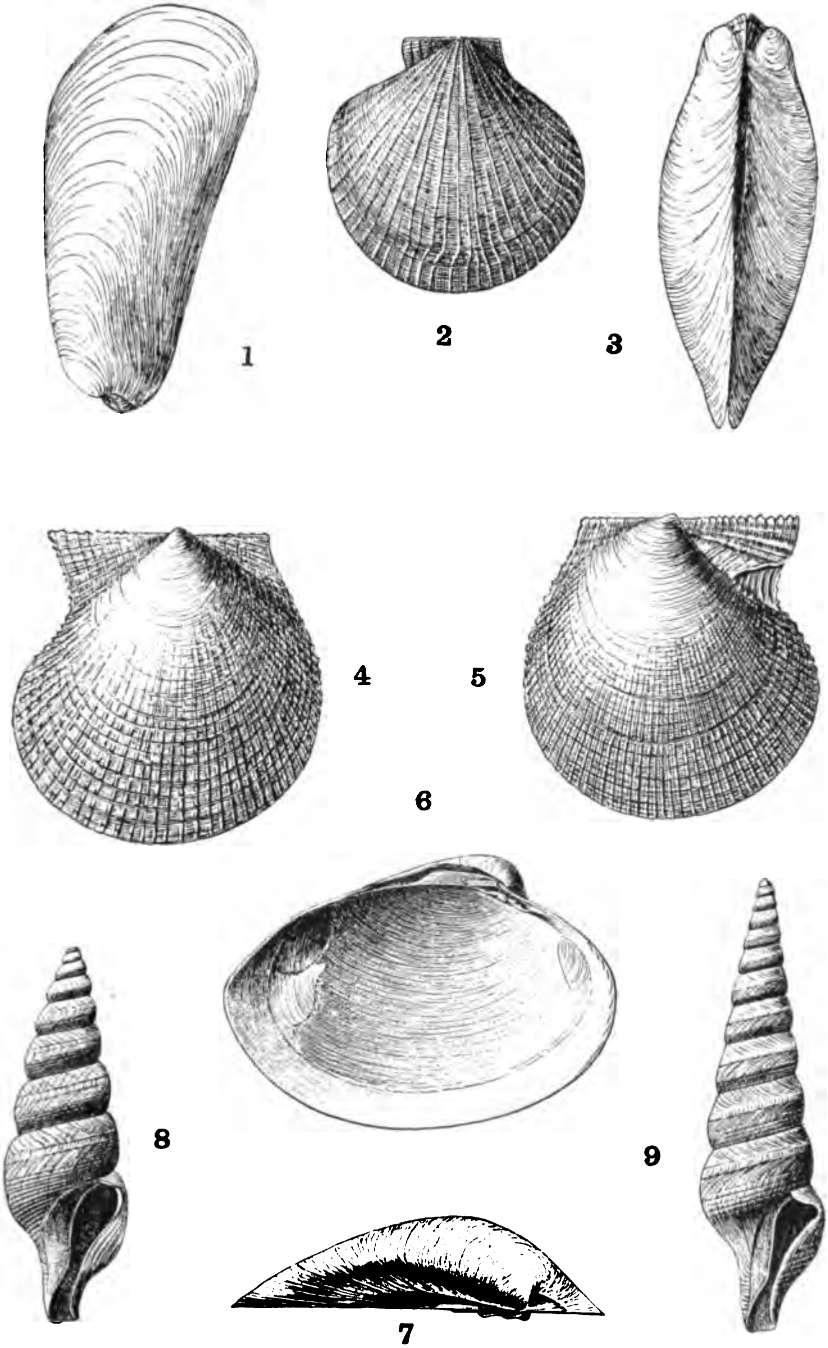

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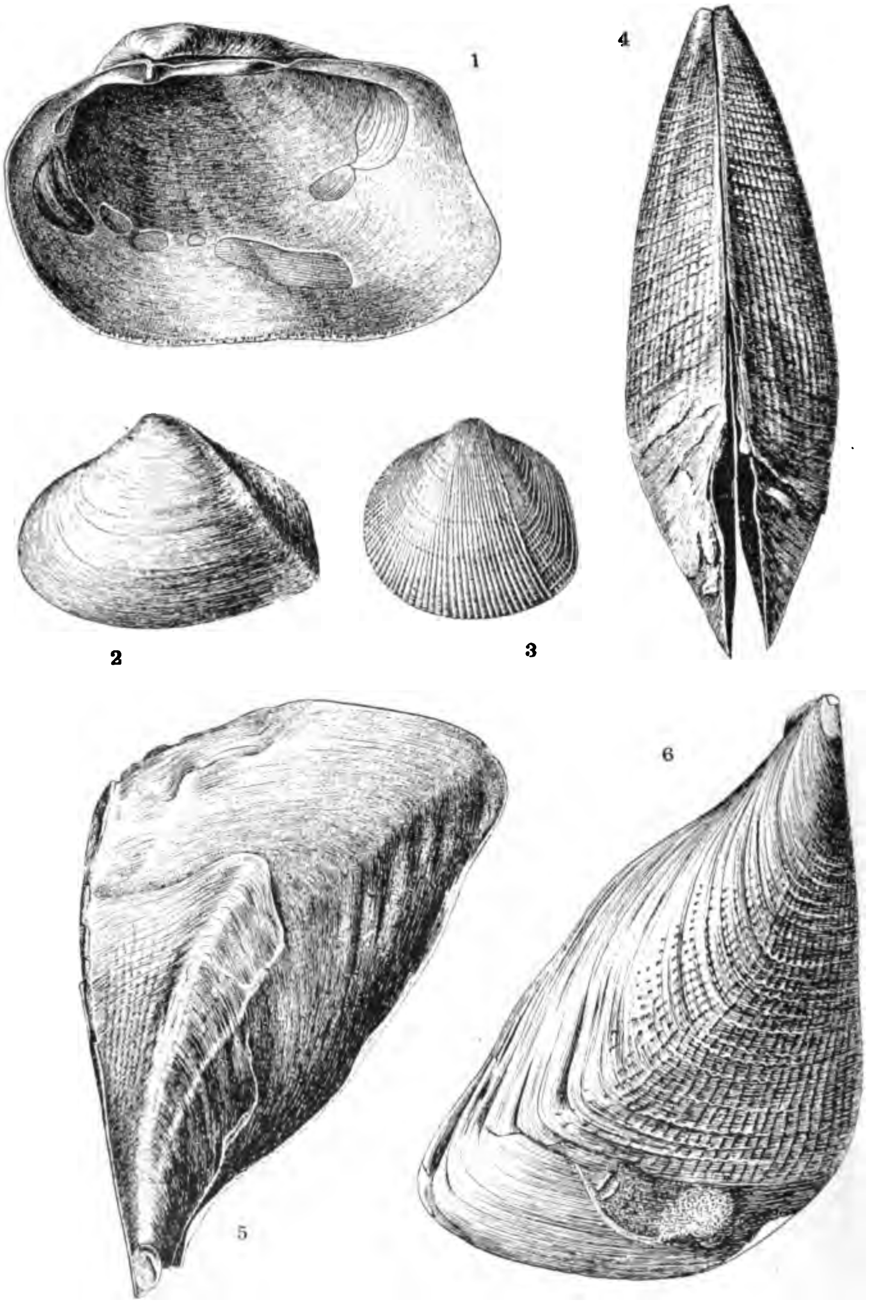

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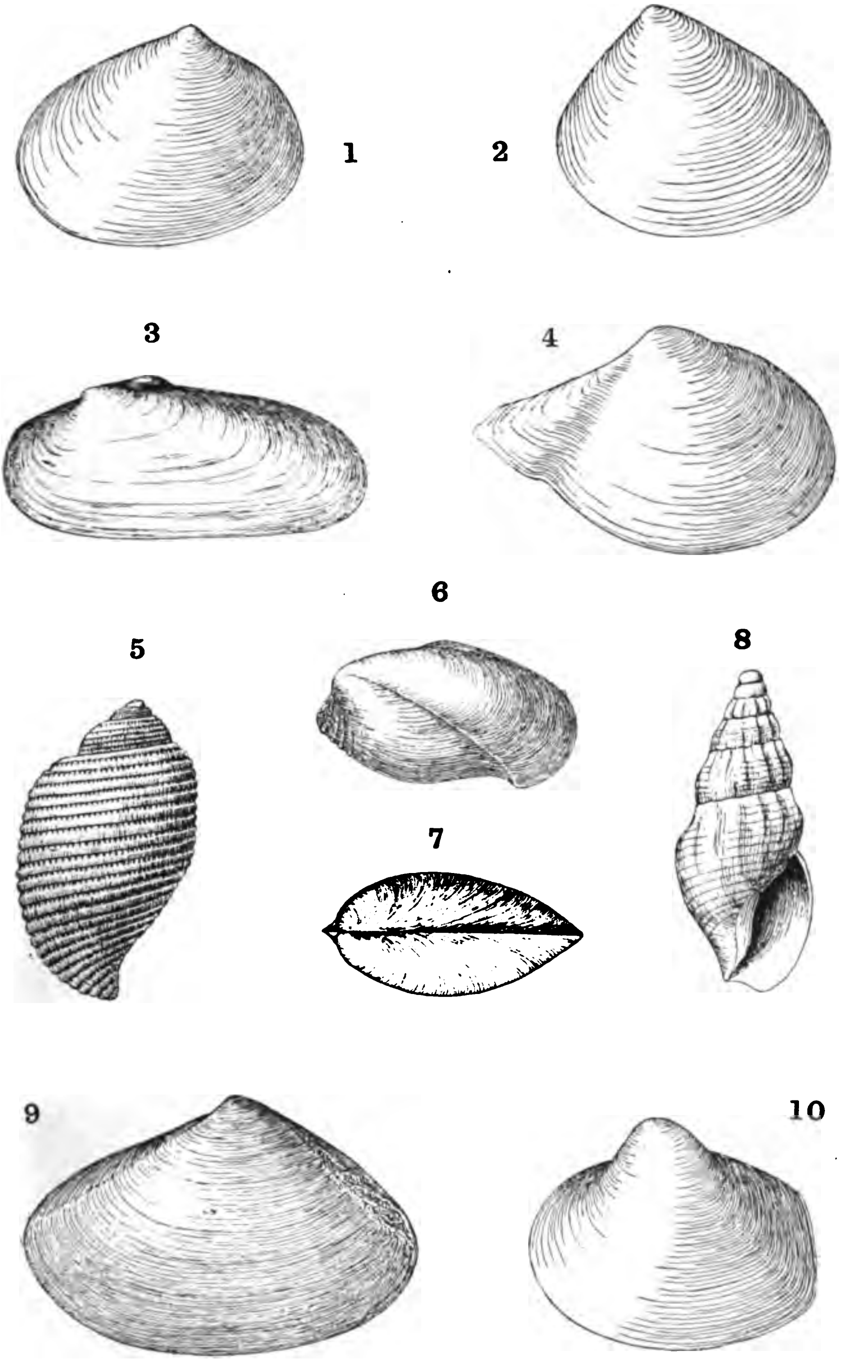

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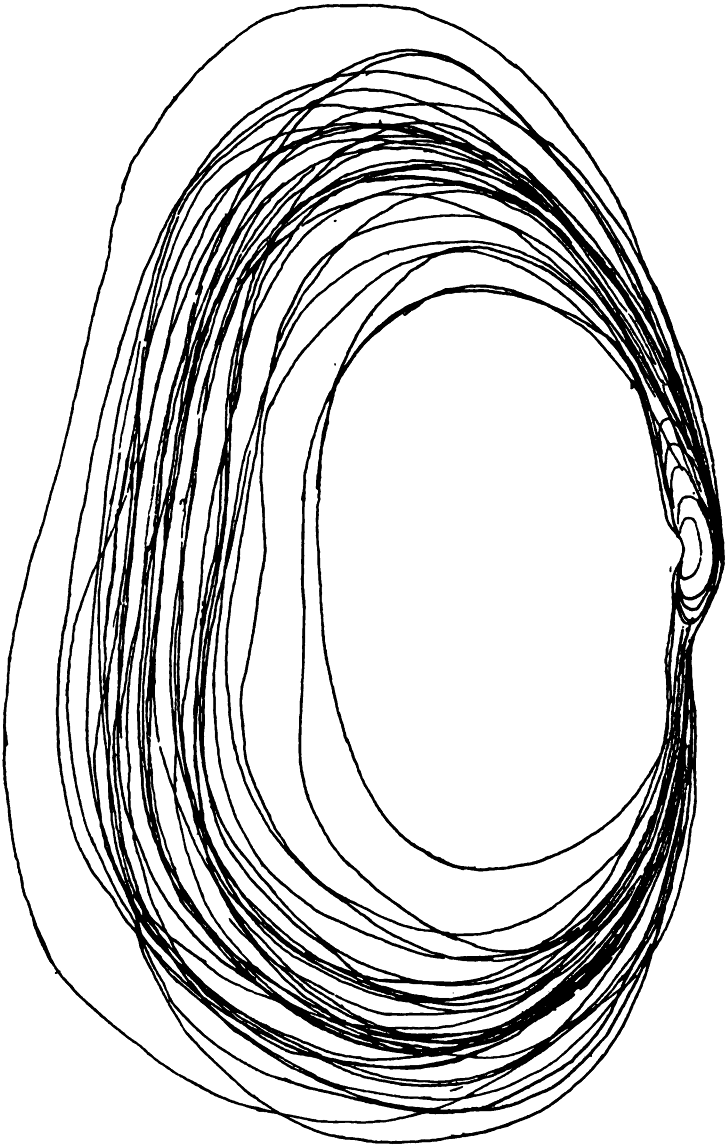

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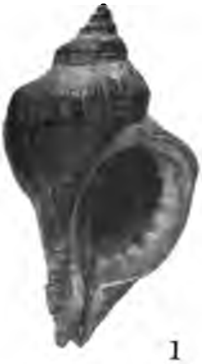

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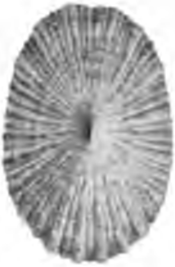

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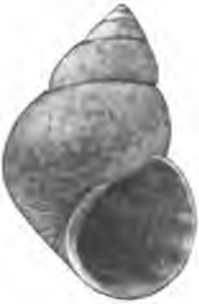

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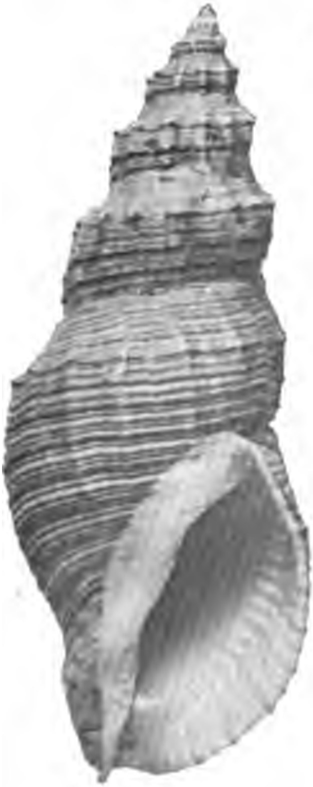

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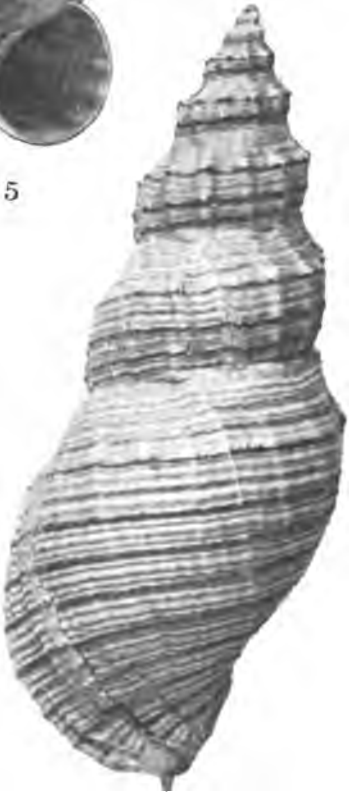

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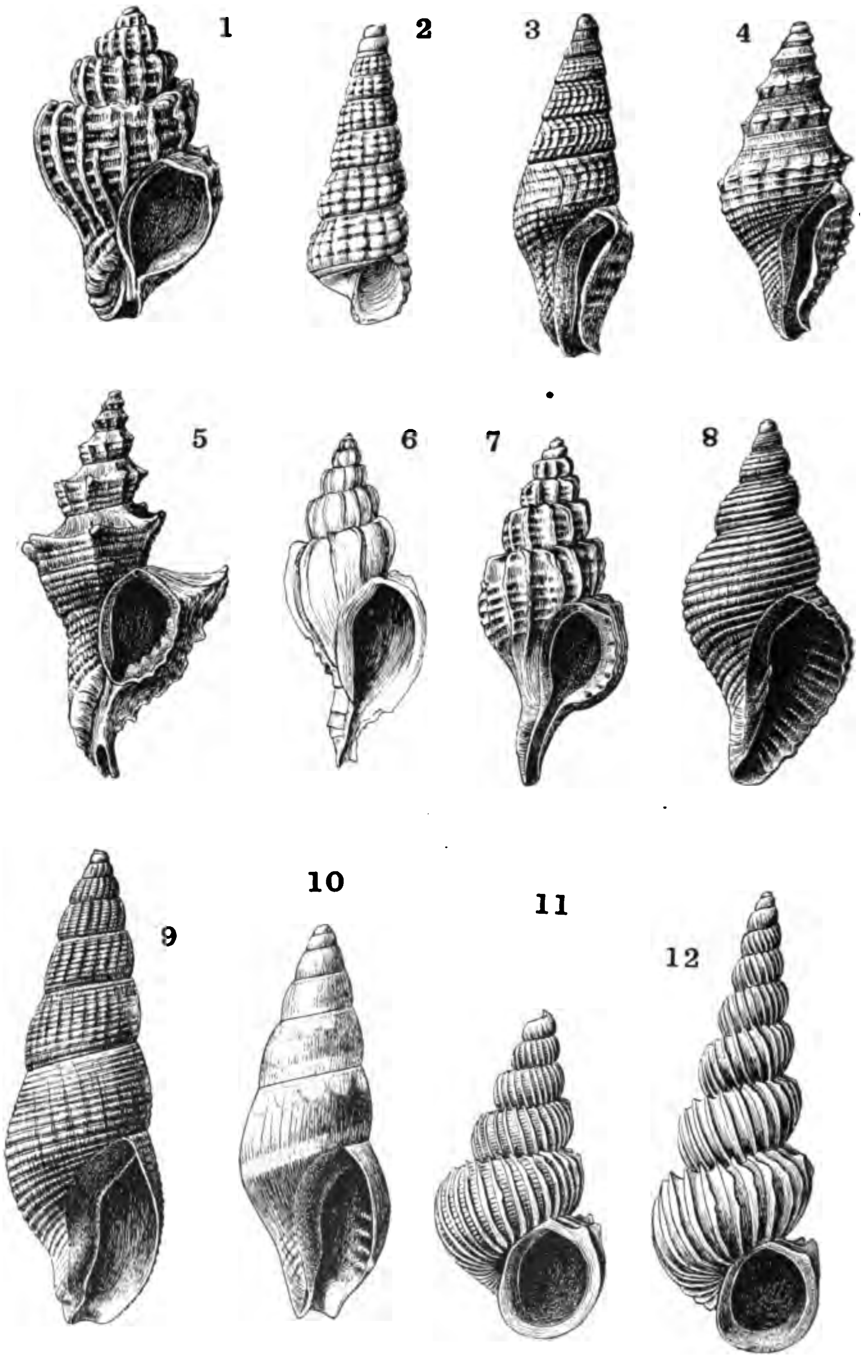

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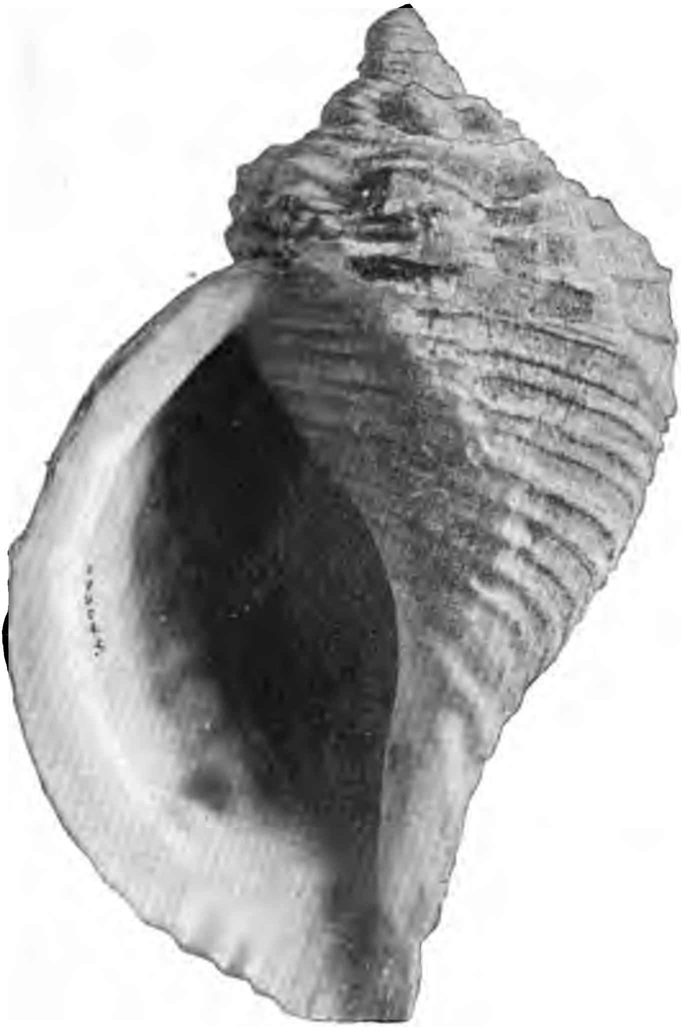
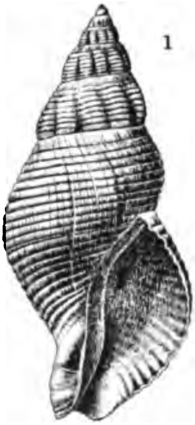


NORTHWEST AMERICAN SHELL-BEARING MOLLUSKS.

PYRULOFUSUS HARPA MÖRCH, SEE PAGE 214.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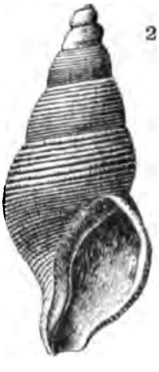
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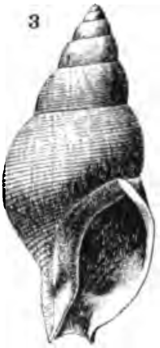
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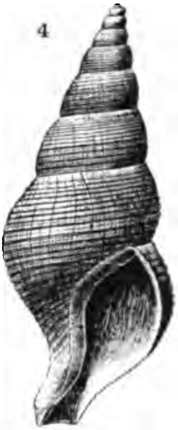
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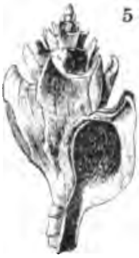
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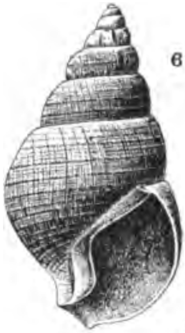
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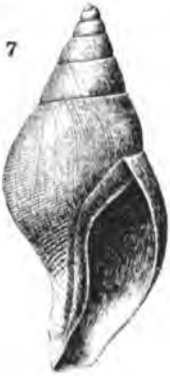
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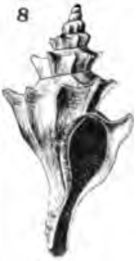
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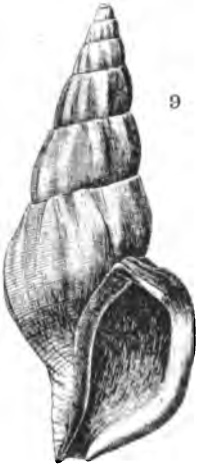
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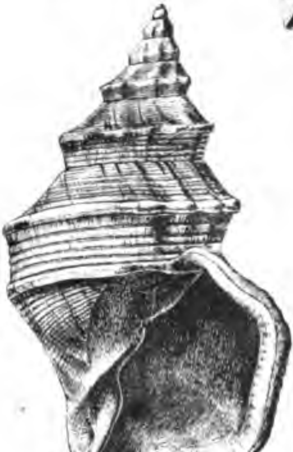
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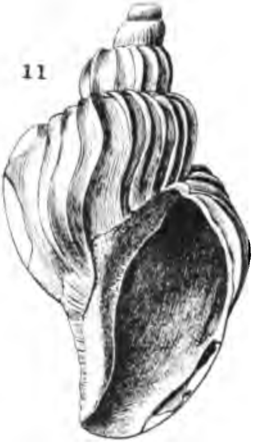
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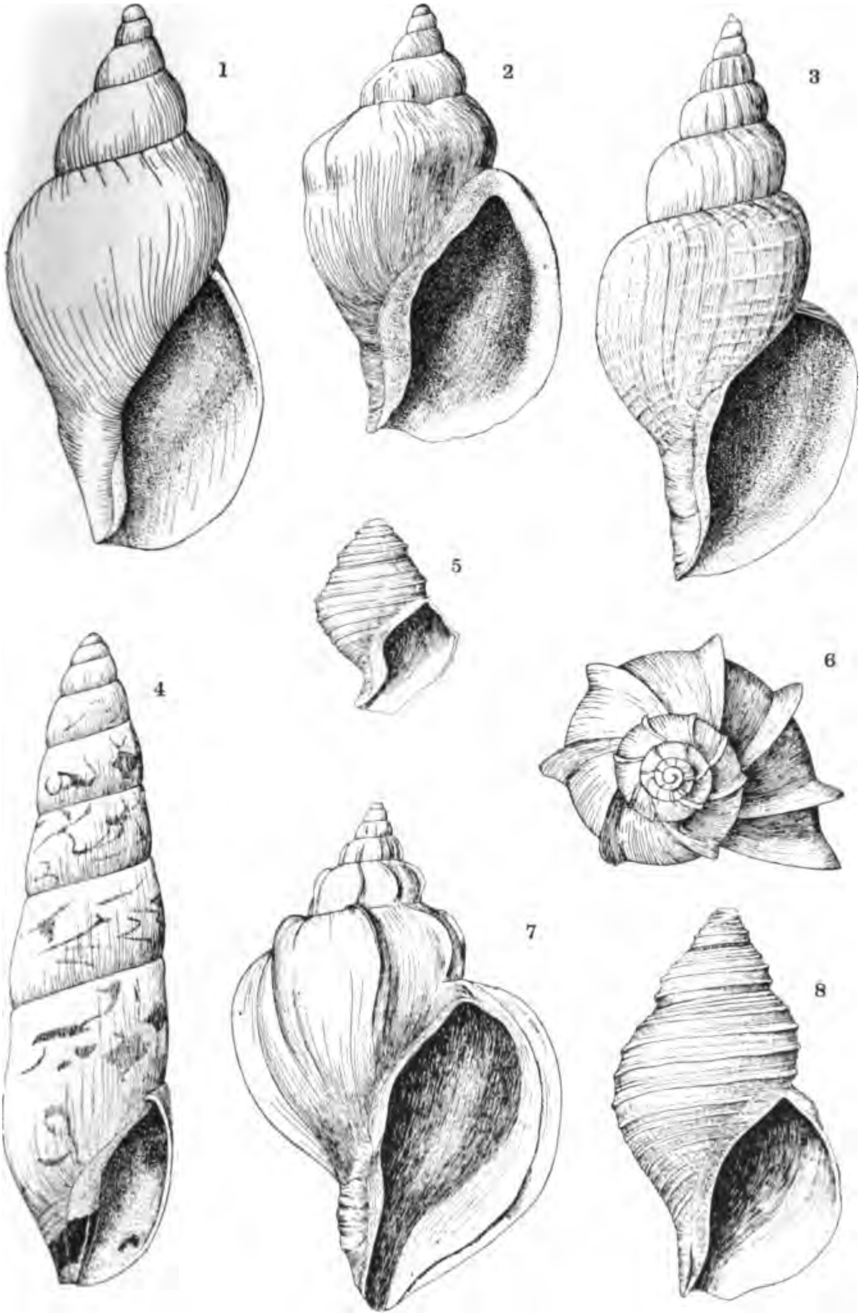
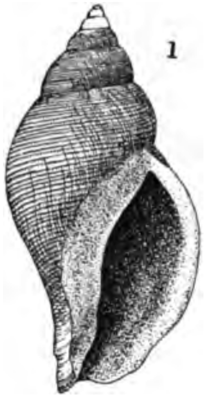


Northwest American Shell-Bearing Mollusks.

For explanation of plate see page 214.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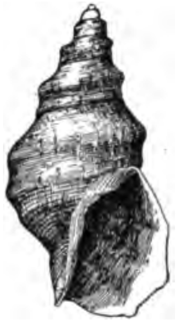
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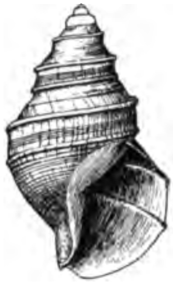
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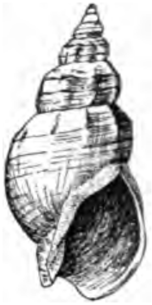
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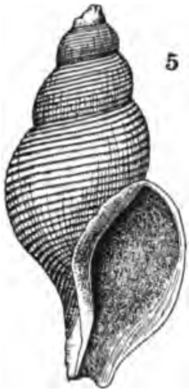
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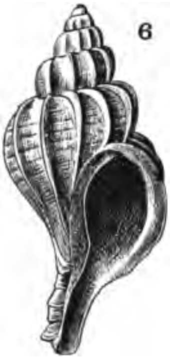
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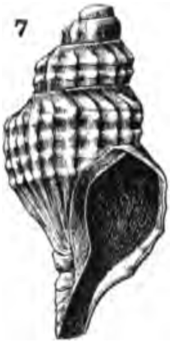
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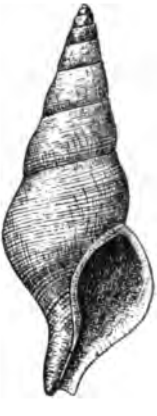
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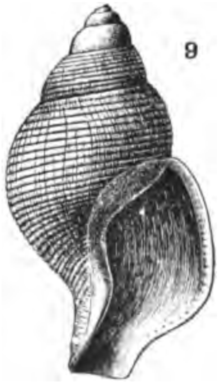
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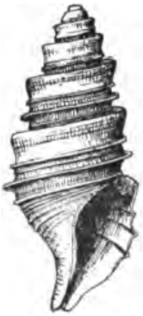
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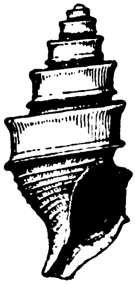
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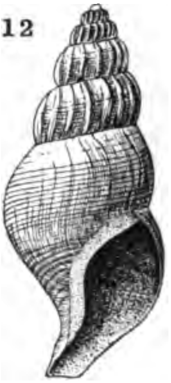
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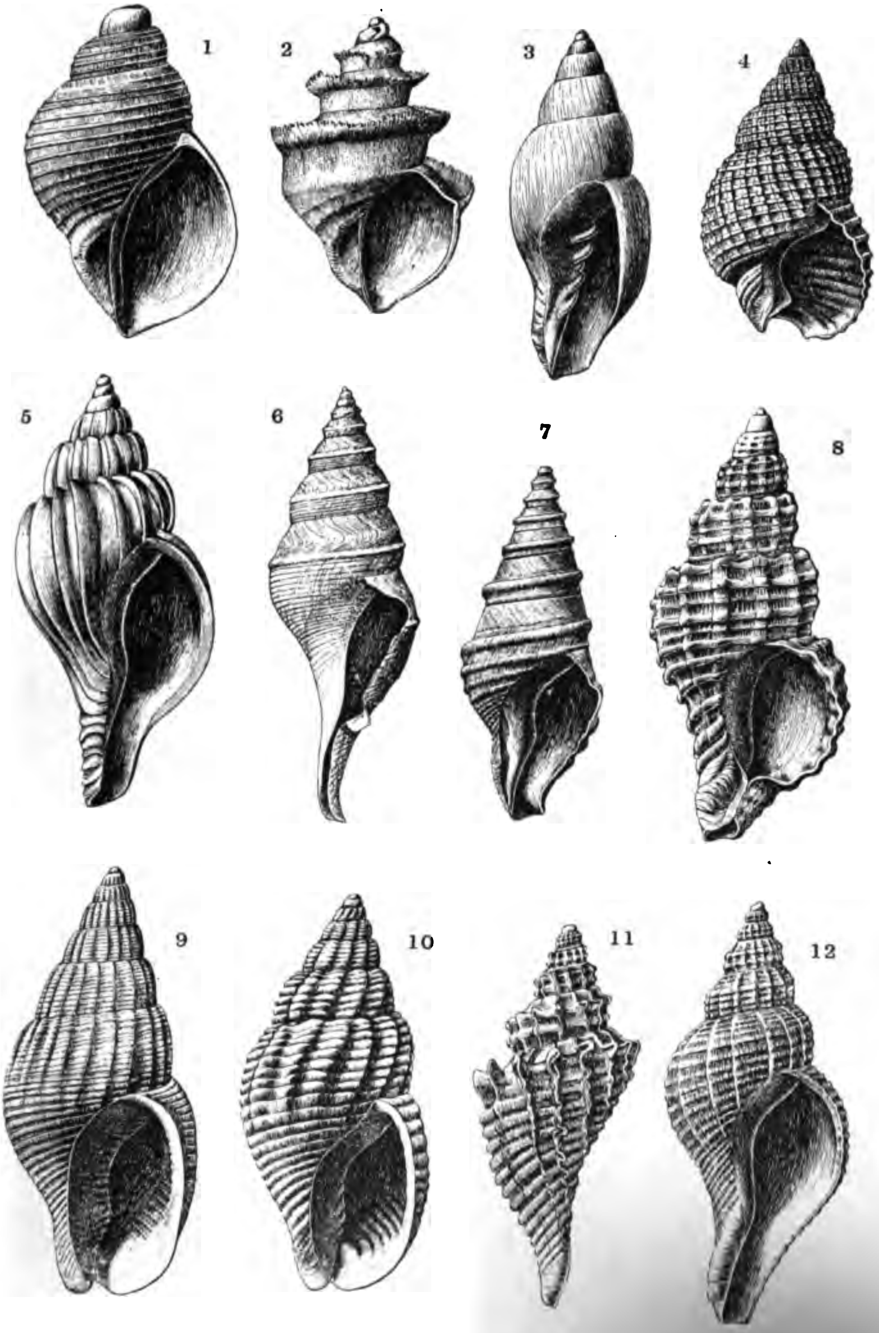
FOR EXPLANATION OF PLATE SEE PAGES 214 AND 215.



NORTHWEST AMERICAN SHELL-BEARING MOLLUSKS.

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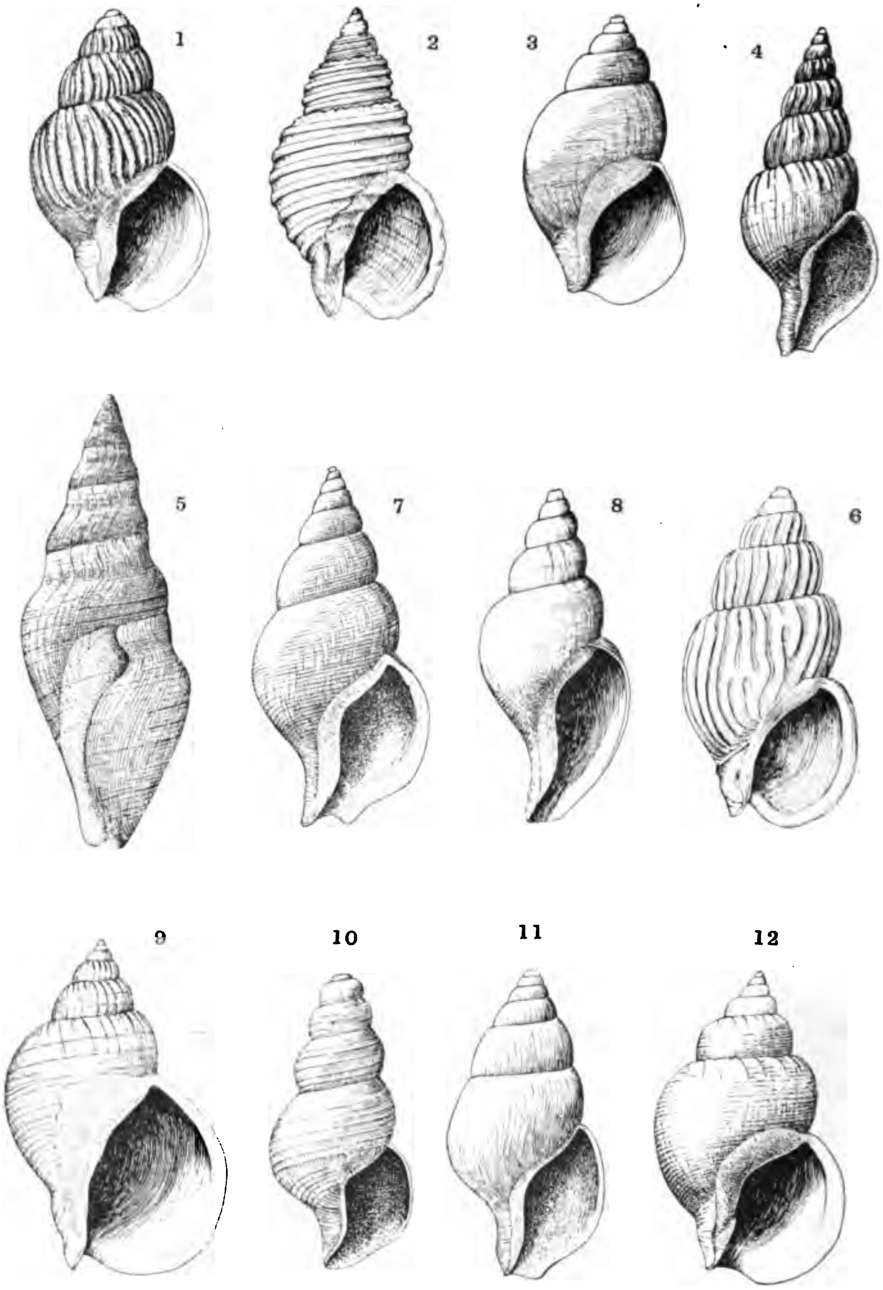

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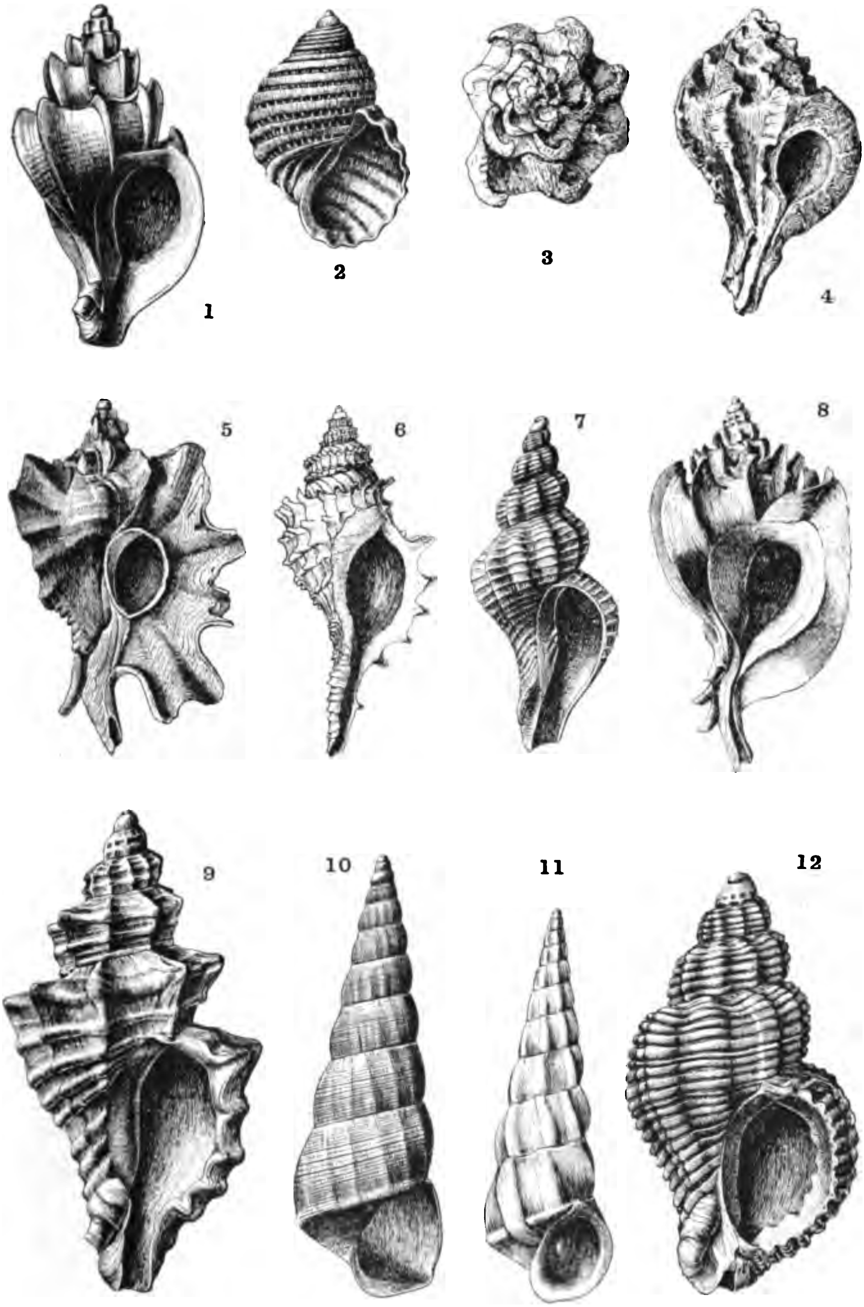

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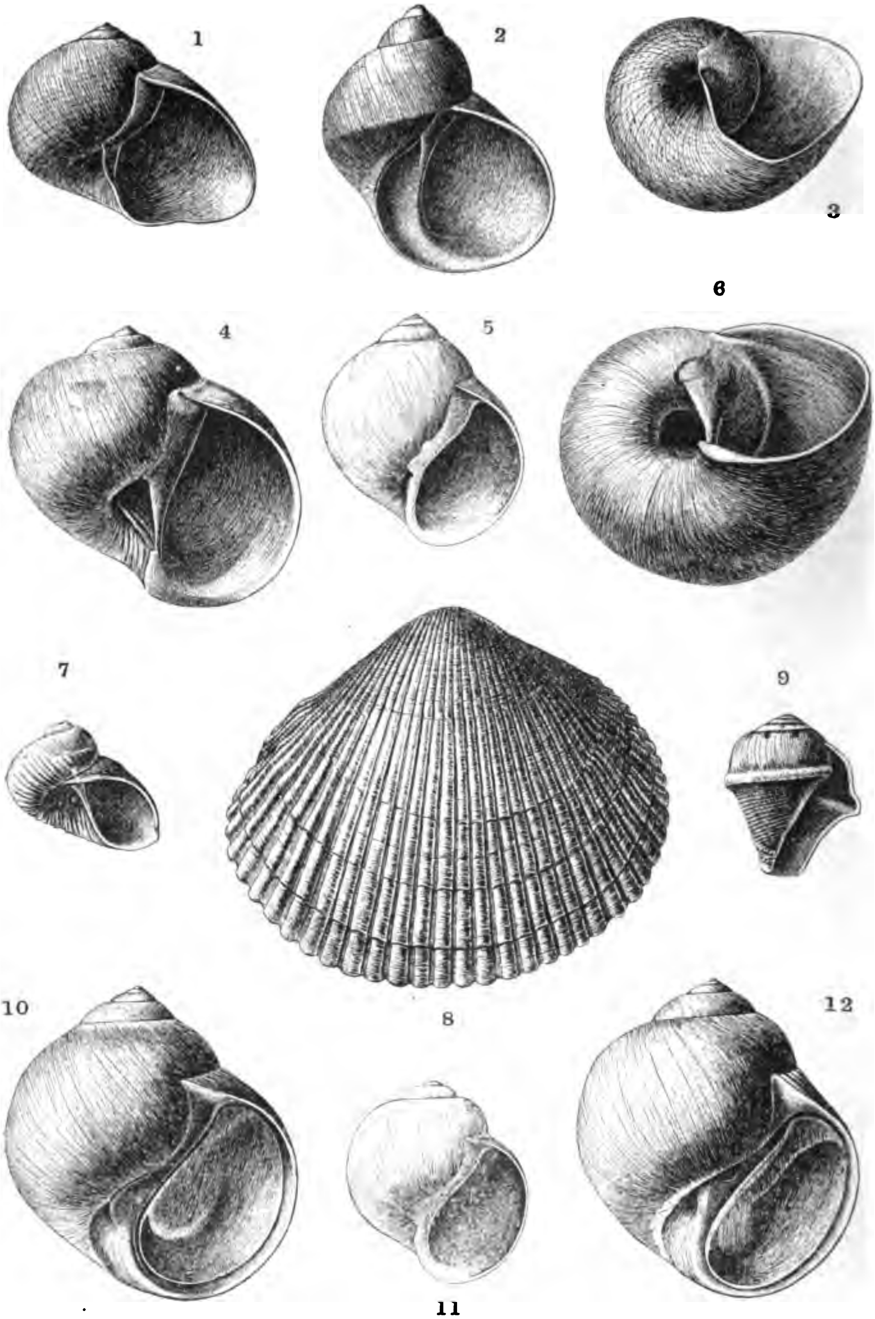

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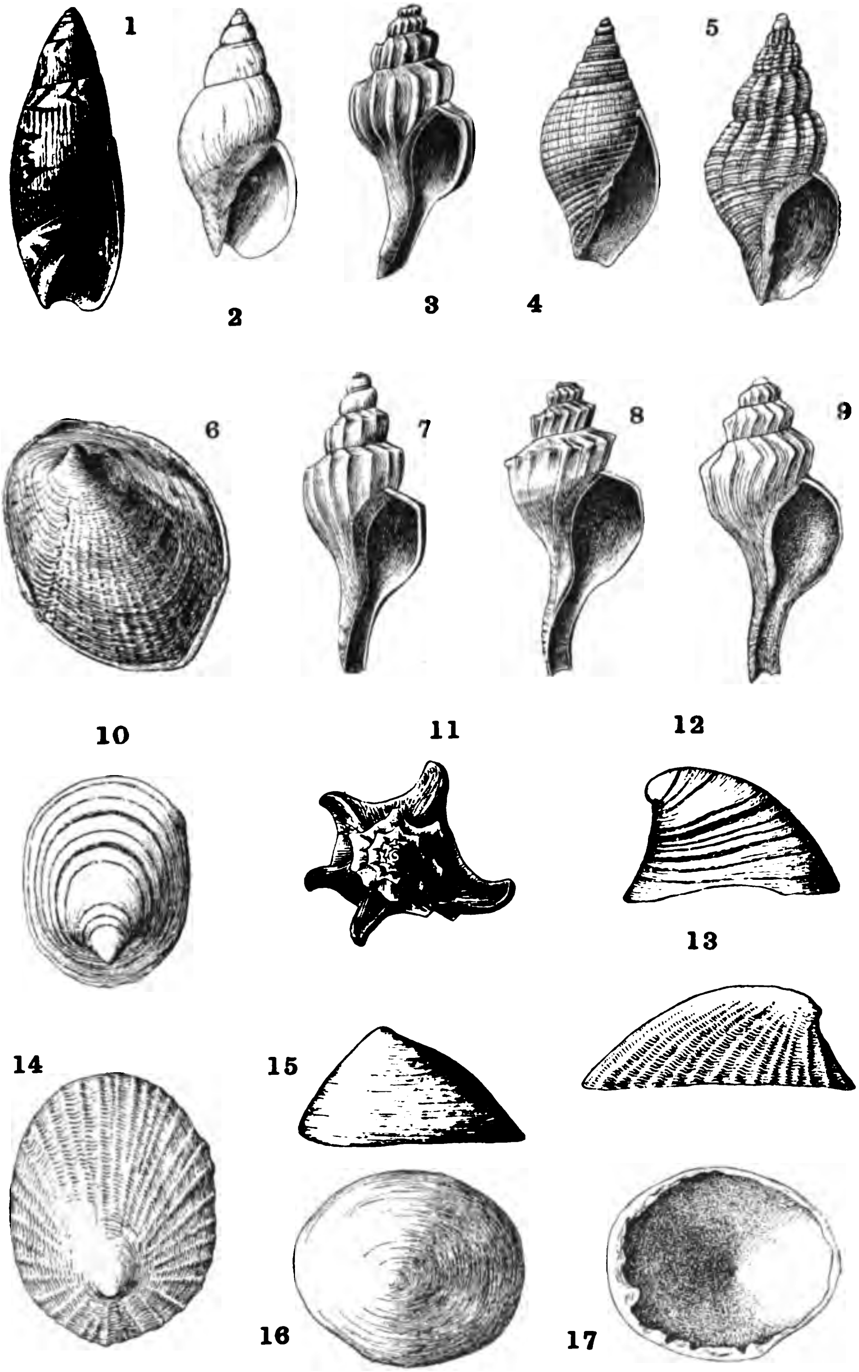

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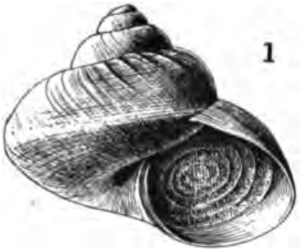

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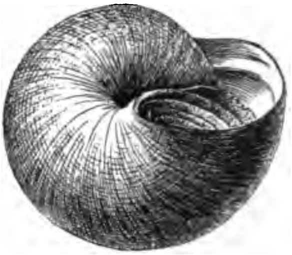

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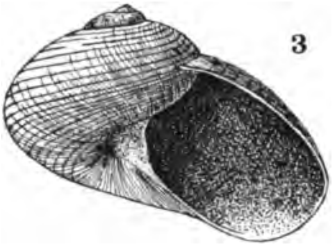

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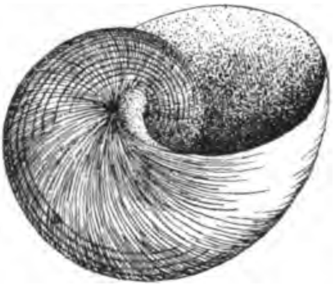

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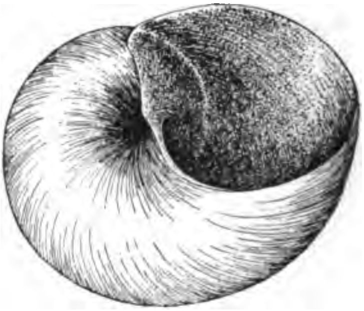

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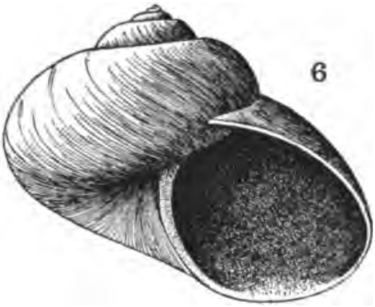

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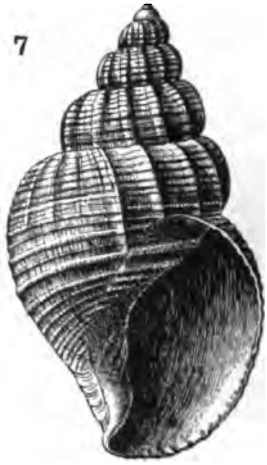

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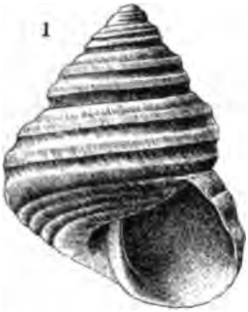

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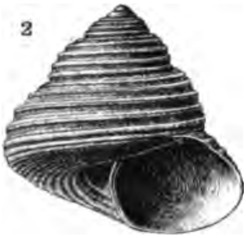

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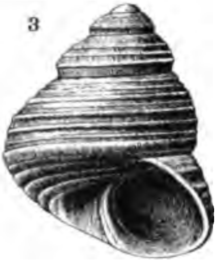

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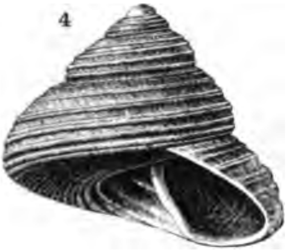

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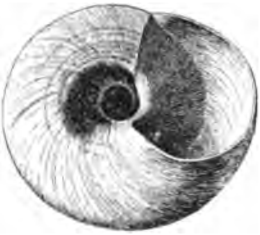

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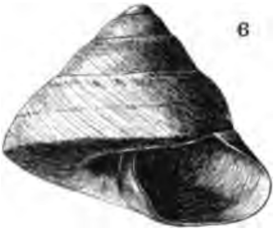

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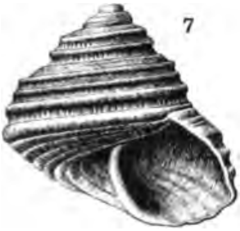

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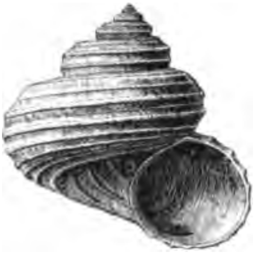

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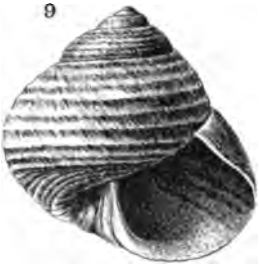

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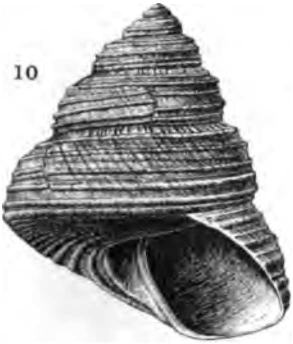

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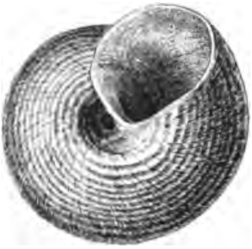

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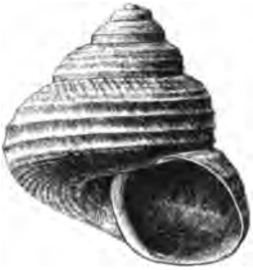

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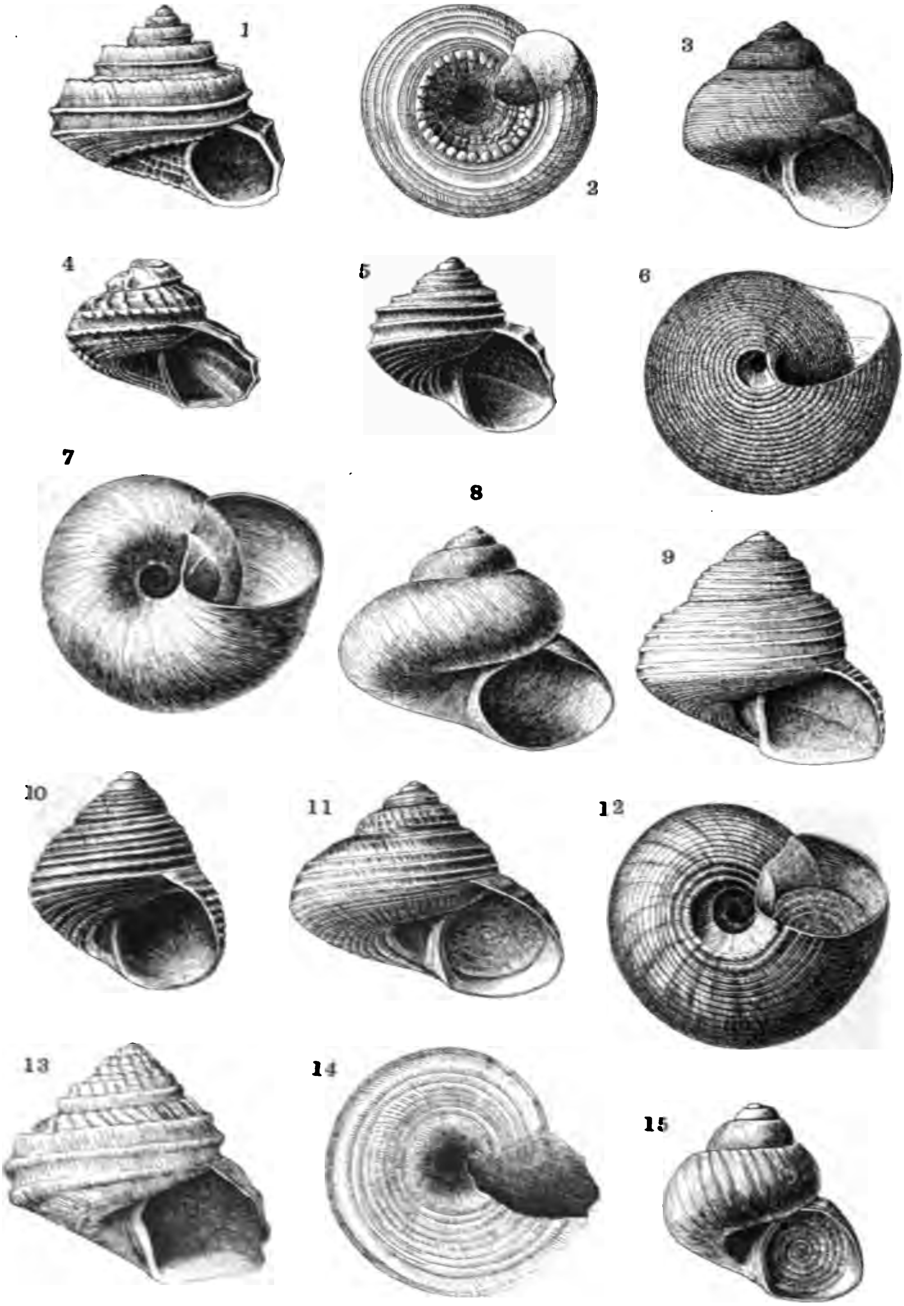

NORTHWEST AMERICAN SHELL-BEARING MOLLUSKS.

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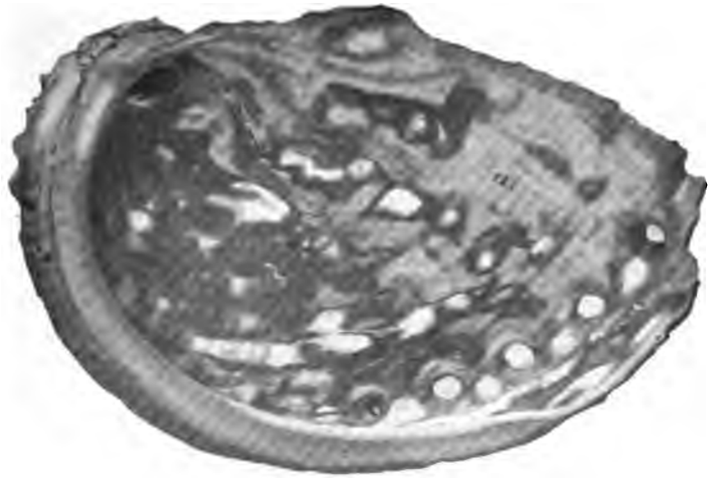

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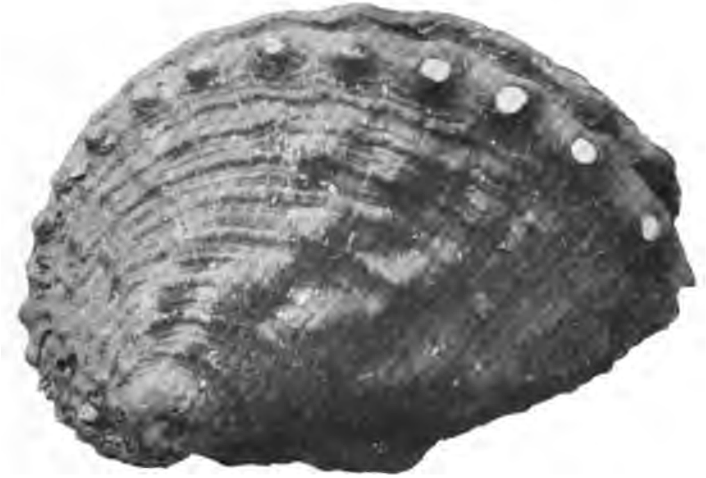

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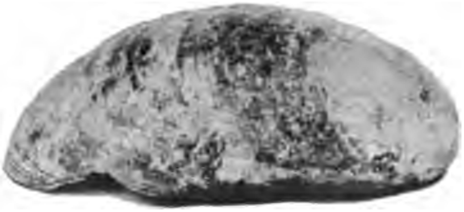

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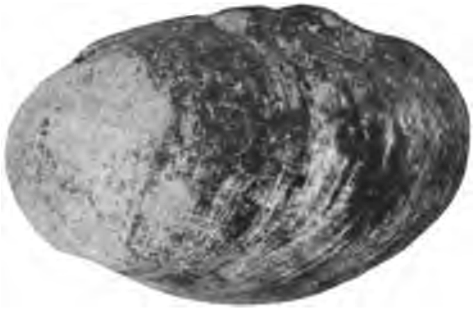

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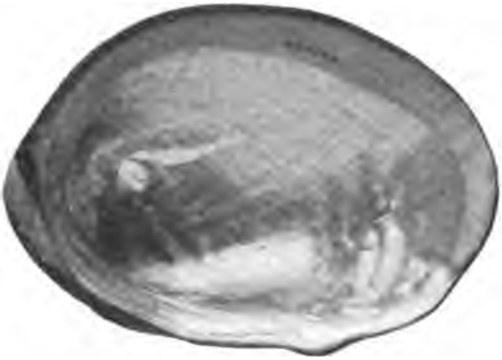

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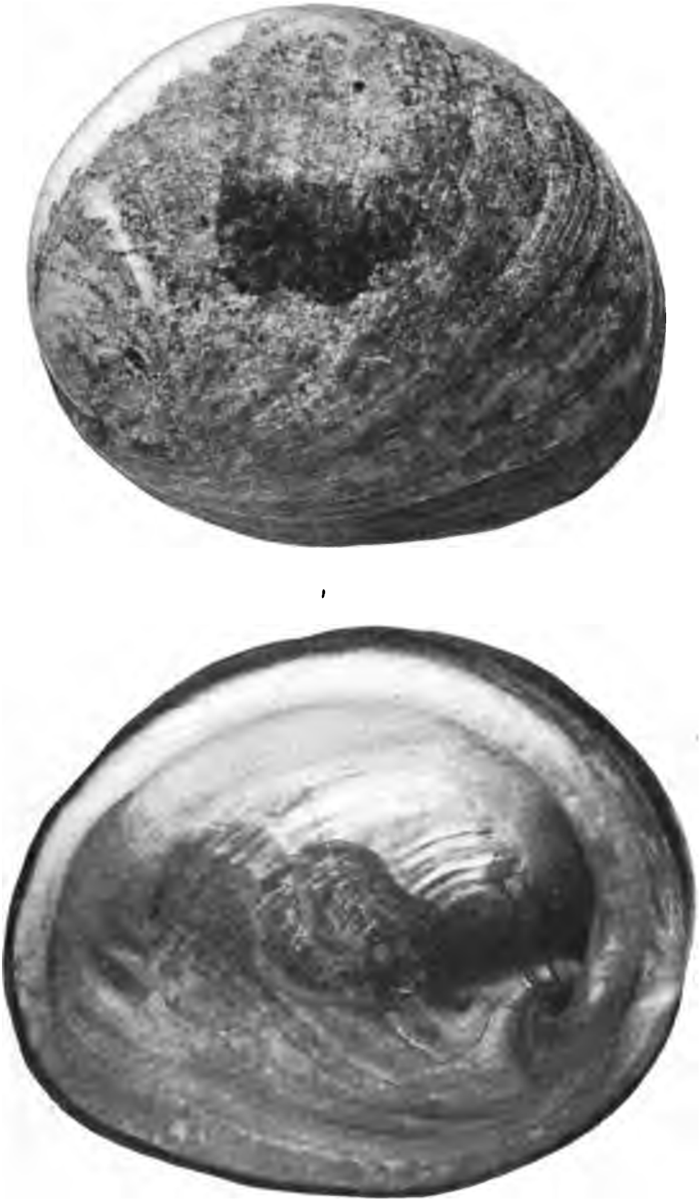
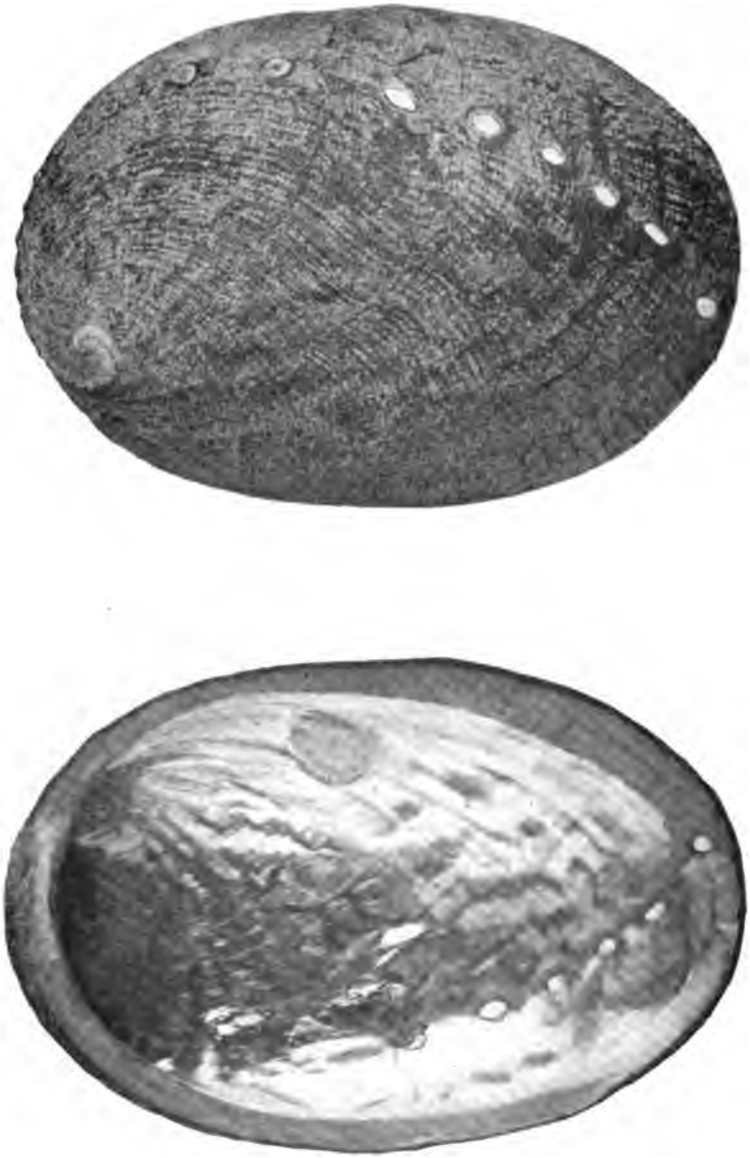


NORTHWEST AMERICAN SHELL-BEARING MOLLUSKS.

HALIOTIS CRACHERODII IMPERFORATA DALL. SEE PAGE 217.



NORTHWEST AMERICAN SHELL-BEARING MOLLUSKS.

HALIOTIS WALLALENSIS STEARNS, SEE PAGE 217.

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UNITED STATES NATIONAL MUSEUM
Bulletin 113

LIFE HISTORIES OF NORTH AMERICAN GULLS AND TERNS

ORDER LONGIPENNES

BY

ARTHUR CLEVELAND BENT
Of Taunton, Massachusetts

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

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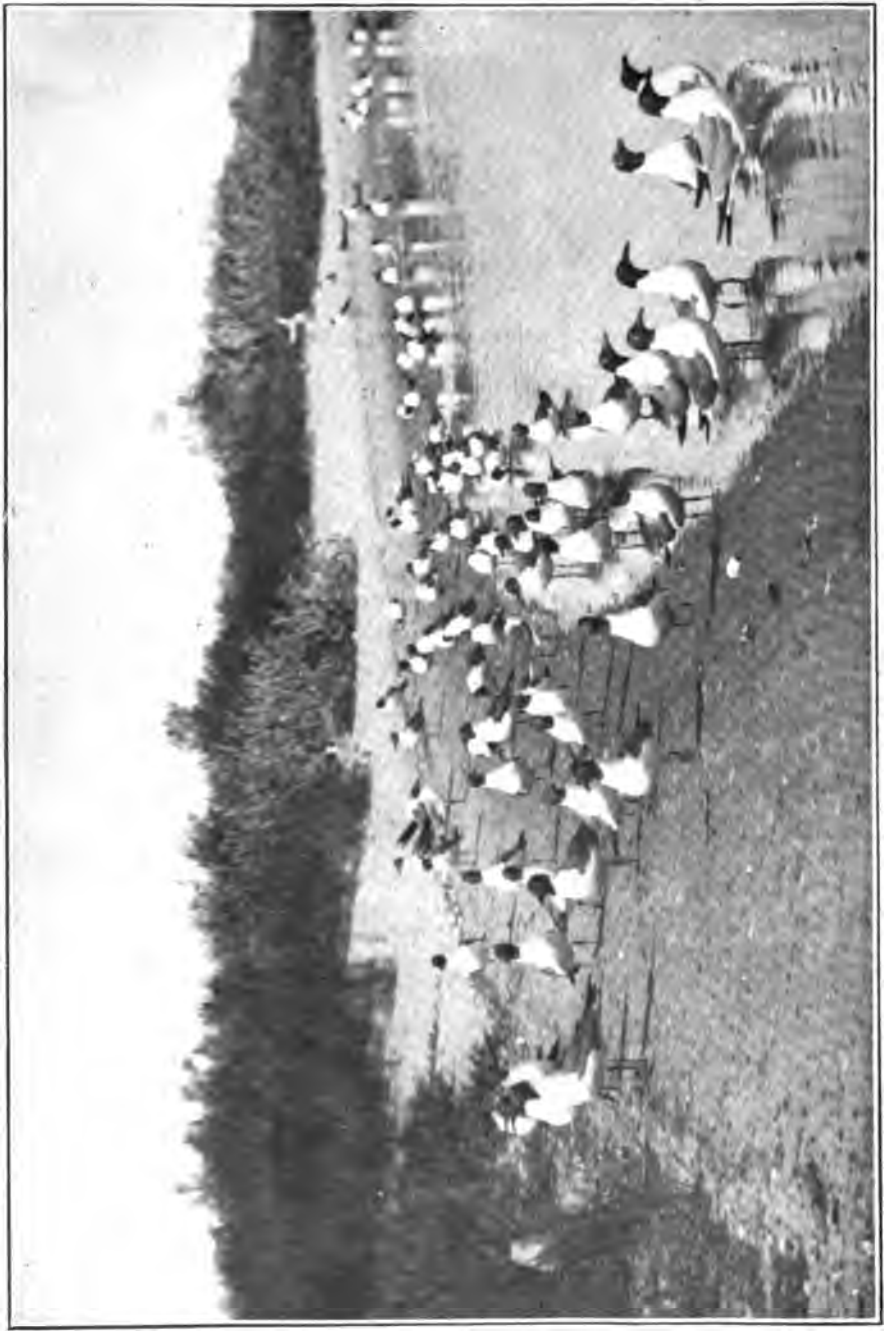

Battledore Island, Louisiana.

LAUGHING GULL.

H. K. Job.

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 113

LIFE HISTORIES OF NORTH AMERICAN GULLS AND TERNS

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ADVERTISEMENT.

The scientific publications of the United States National Museum consist of two series, the *Proceedings* and the *Bulletins*.

The *Proceedings*, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original, and usually brief, papers based on the collections of the National Museum, presenting newly-acquired facts in zoology, geology, and anthropology, including descriptions of new forms of animals, and revisions of limited groups. One or two volumes are issued annually and distributed to libraries and scientific organizations. A limited number of copies of each paper, in pamphlet form, is distributed to specialists and others interested in the different subjects as soon as printed. The date of publication is recorded in the tables of contents of the volumes.

The *Bulletins*, the first of which was issued in 1875, consist of a series of separate publications comprising chiefly monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, and catalogues of type-specimens, special collections, etc. The majority of the volumes are octavos, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable.

Since 1902 a series of octavo volumes containing papers relating to the botanical collections of the Museum, and known as the *Contributions from the National Herbarium*, has been published as bulletins.

The present work forms No. 113 of the *Bulletin series*.

William deC. Ravenel,
Administrative Assistant to the Secretary,
In charge of the United States National Museum.

Washington, D. C.

INTRODUCTION.

This Bulletin contains a continuation of the work on the life histories of North American birds, begun in Bulletin 107. The same general plan has been followed and the same sources of information have been utilized. Nearly all of those who contributed material for, or helped in preparing, the former volume have rendered similar service in this case. In addition to those whose contributions have been previously acknowledged, my thanks are due to the following contributors:

Photographs have been contributed, or their use authorized, by D. Appleton & Co., S. C. Arthur, A. M. Bailey, R. H. Beck, B. S. Bowdish, L. W. Brownell, G. G. Cantwell, F. M. Chapman, H. H. Cleaves, Colorado Museum of Natural History, E. H. Forbush, A. O. Gross, O. J. Heinemann, A. L. V. Manniche, W. M. Pierce, M. S. Ray, J. Richardson, R. B. Rockwell, R. W. Shufeldt, J. F. Street, University of Minnesota, C. H. Wells, J. Wilkinson, and F. M. Woodruff.

Notes and data have been contributed by S. C. Arthur, R. H. Beck, F. H. Carpenter, H. H. Cleaves, E. H. Forbush, F. C. Hennessey, R. Hoffmann, F. C. Lincoln, H. Massey, O. J. Murie, C. J. Pennock, J. H. Rice, Katie M. Roads, and G. H. Stuart. With the consent of Dr. L. C. Sanford and R. H. Beck, the American Museum of Natural History has placed at the author's disposal Mr. Beck's extensive notes made on the Brewster and Sanford expedition to South America.

The distributional part of this Bulletin has been done mainly by the author, with considerable volunteer help from Mr. F. Seymour Hersey, whose time is now otherwise occupied. Dr. Louis B. Bishop has devoted much time to revising the paragraphs on distribution and on plumages.

Our attention has been called to an error in Bulletin 107. On page 32 a quotation from Dr. T. S. Roberts was inserted as referring to the food of the eared grebe; this really refers to the food of Franklin's gull and not to that of the grebe.

Readers of Bulletin 107 have suggested some changes. Consequently, in this and subsequent Bulletins in this series, the exact details will be given, when available, in such casual records as are given; but it must be remembered that no attempt will be made to mention *all* casual records; only a few can be given, to suggest the limits of the wanderings of the species. Another addition of value, suggested and furnished by Dr. T. S. Palmer, is information regarding reservations and the species which are protected in them. As some readers have questioned the scale on which the eggs are illustrated, it seems desirable to say that in Bulletin 107, in this one, and in subsequent Bulletins, all eggs are, and will be, shown exactly life-size, the plates being produced by an exact photographic process.

THE AUTHOR.

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LIFE HISTORIES OF NORTH AMERICAN GULLS AND TERNS, ORDER LONGIPENNES.

By Arthur Cleveland Bent,
of Taunton, Massachusetts.

Family STERCORARIIDAE, Skuas and Jaegers.

CATHARACTA SKUA Brünnich.

SKUA.

HABITS.

The following quotation from the graphic pen of Mr. F. St. Mars (1912) gives a better introduction to this bold and daring species than anything I could write, and his article, The Eagle Guard, from which I shall quote again, is well worth reading as a striking character study:

> Then the scimitar wings shut with a crisp swish, and he became a statue in dull, unpolished bronze, impassively regarding the polecat, who lay with her back broken, feebly struggling to drag into cover. It is a shock to the human nerves to see the life blasted out of a beast almost 'twixt breath and breath; what one moment is a gliding, muscular form, instinct with life and energy, confident in power, and the next moment a crumpled heap of fur, twitching spasmodically. But it was a searchlight on the reputation of the eagle guard and the stories one had heard anent the superstitions of the natives.
>
> The polecat, being hungry with the gnawing hunger of a mother and presuming on a swirl of mist, had tried to steal up the knoll to the two great eggs that lay in the hollow atop all unguarded. Had come then a thin, high, whirring shriek, exactly like the noise made by a sword cutting through the air, and a single thud that might have been the thud of a rifle bullet striking an animal. Then—well, then the scene described above.
>
> Big, powerfully built, brown with the black brown of his own native peat bogs, armed to the teeth, long and slash-winged, whose flight feathers were like the cutting edge of a sword, insolent with the fine, swelling insolence of power, and greatly daring, no wonder men had chosen him as the eagle guard, this mighty bird, this great skua of the naturalists, this Bonxie, mascot, and superstitious godling of the fishermen. Wah! he was a bird.

We know so little about the skua, as an American bird, that I shall have to draw largely from European writers for its life history. It is rare on the American side of the Atlantic Ocean, and is not known to breed here regularly, although it probably does so occasionally or sparingly in Greenland or on the Arctic Islands.

Nesting.—Yarrell (1871) says:

> The great skua arrives in the Shetlands about the end of April, and its nest, which consists of a neatly rounded cavity in the moss and heather of the highest moorlands, is prepared in the latter half of May. According to Maj. Feilden, the birds appear to prepare several nests before they decide on using one. There is no difficulty in finding the nests, as the parent birds at once attack any intruder upon their domain with fierce and repeated swoops. When handling the nestling the editor found their assaults were unremitting; first one bird and then the other wheeling ~~short,~~ and coming down at full speed, almost skimming the ground. At about 15 yards' distance the strong clawed feet are lowered and held stiffly out, producing for the moment a very ungainly appearance, and it seems as if the bird would strike the observer full in the center of the body, but on quickly raising the hand or stick the bird rises also, the whirr and vibration of its pinions being distinctly heard and felt. Its ordinary flight is soaring and stately. On leaving the territory of one pair, the attack is taken up by another, and so on; for the great skuas do not nest in close proximity.

Morris (1903) writes:

> The nest of the skua is of large size, as well as somewhat carefully constructed; the materials used being grasses, lichens, moss, and heath. The bird places it on the tops of the mountains or cliffs in the neighborhood of the sea, but not on the rocks themselves. They build separately in pairs.

Eggs.—The skua lays ordinarily two eggs, rarely three, and sometimes only one. These vary in shape from ovate or slightly elongated ovate to short ovate. The shell is smooth, with a dull luster. The ground color is "Saccardo's olive," "Isabella color," or "deep olive buff." The markings are usually not profuse and consist of spots and blotches, scattered irregularly over the egg, of "sepia," "bister," "snuff brown," or "tawny olive." There are also usually a few faint spots or blotches of pale shades of drab or gray. Rev. F. C. R. Jourdain has collected for me the measurements of 68 eggs, which average 70.58 by 49.43 millimeters; the eggs showing the four extremes measure **76.3** by 50.4, 71.5 by **53.2,** and **62** by **44.5** millimeters.

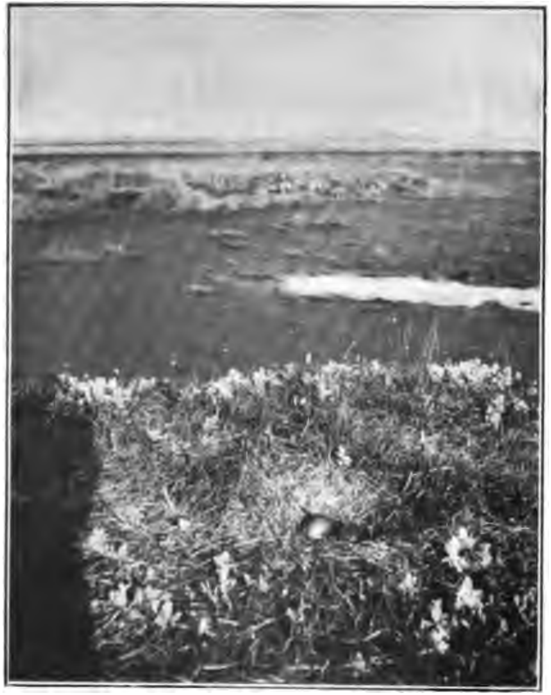
Young.—Macgillivray (1852) quotes Captain Vetch as saying:

> The young bird is a nimble, gallant little animal, and almost as soon as hatched leaves the nest. On the approach of danger he secretes himself in holes or behind stones with great art, and when captured at least makes a show of defense that is quite amusing.

Plumages.—I have never seen the downy young, but Coues (1903) describes it as "buffy-gray, ruddier above than below." Ridgway (1887) quotes Dresser as calling it "brownish or cinnamon-gray, rather darker in color on the upper parts than on the under surface of the body."

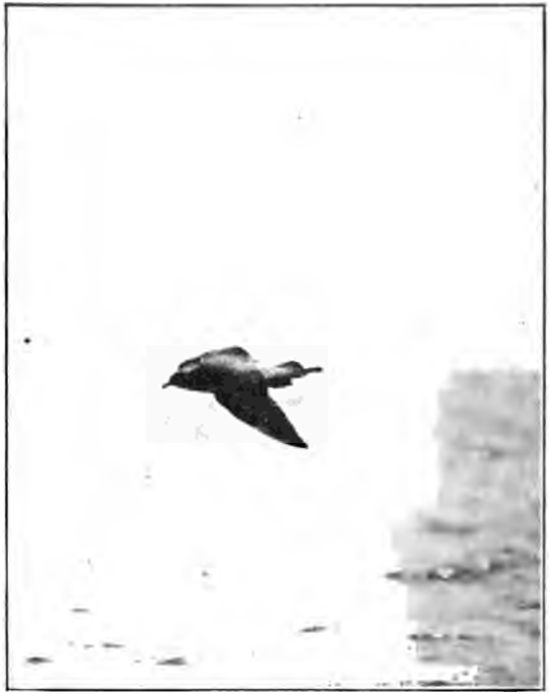
I have not been able to examine enough specimens to come to any definite conclusions as to the sequence of molts and plumages. Coues (1903) gives the following good description of the young of the year:

> Size much less; bill weaker and slenderer; cere illy developed; striae not apparent and its ridges and angles all want sharpness of definition. Wings



Kaldafarnes, Iceland. J. Wilkin n.

SKUA.



Chatham, Mass. H. K. Job.

POMARINE JAEGER.

FOR DESCRIPTION SEE PAGE 329.

short and rounded, the quills having very different proportional length from those of adults; second longest, third but little shorter, first about equal to fourth. The inner or longest secondaries reach, when the wing is folded, to within an inch or so of tip of longest primary. Central rectrices a little shorter than the next. Colors generally as in adult, but duller and more blended, having few or no white spots; reddish spots dull, numerous, and large, especially along edge of forearm and on least and lesser coverts. On underparts the colors lighter, duller, and more blended than above; prevailing tint light dull rufous, most marked on abdomen, but there and elsewhere more or less obscured with ashy or plumbeous. Remiges and rectrices dull brownish-black; their shafts yellowish-white, darker terminally. At bases of primaries there exists the ordinary large white space, but it is more restricted than in adults, and so much hidden by the bastard quills that it is hardly apparent on outside of wing, though conspicuous underneath.

Young birds may become indistinguishable from adults at the first postnuptial molt, when a little over a year old, but perhaps not for a year or two later.

Adults seem to have but one complete molt—the postnuptial—in August. Adults can be distinguished by their larger size and by the elongated feathers of the neck with the whitish central streaks.

Food.—Yarrell (1871) writes of the food of the skua:

> Their food is fish, but they devour also the smaller water birds and their eggs, the flesh of whales, as well as other carrion, and are observed to tear their prey to pieces while holding it under their crooked talons. They rarely take the trouble to fish for themselves, but, watching the smaller gulls and terns while thus employed, they no sooner observe one to have been successful than they immediately give chase, pursuing it with fury; and having obliged it from fright to disgorge the recently swallowed fish, they descend to catch it, being frequently so rapid and certain in their movements and aim as to seize their prize before it reaches the water. The stomachs of a pair which were shot were full of the flesh of the kittiwake, and the castings consisted of the bones and feathers of that small gull. Heysham has noticed an adult female on the coast of Cumberland, which allowed herself to be seized while she was in the act of killing a herring gull. It also feeds on fish offal, and the editor found by the side of a nestling some disgorged but otherwise uninjured herrings of large size.

Behavior.—In appearance as well as in habits the skua seems to share the attributes of the Raptores and the Laridae; its strong, hooked bill and its sharp, curved claws enable it to stand upon and rend asunder the victims of its rapacious habits. Its flight is also somewhat hawk like. Yet it stands horizontally and runs about nimbly like a gull. Morris (1903) says that it "soars at times at a great height, and flies both strongly and rapidly, in an impetuous, dashing manner." Mr. Walter H. Rich has sent me the following notes on the flight of this species:

> When on the wing, which is the greater part of the time, the skua shows in the air hawk like, rather than like the gulls, with whom we rather expect

> to find its resemblances. Its appearance in the air is somewhat like the buteonine hawks, except that its wing action, in its seemingly restrained power and forceful stroke, suggests the unhurried flight of a falcon, or, perhaps, more accurately—since the wings are at all times fully opened, employing their full sweep in their action, their primaries slightly separated at the tips and slightly recurved—the majestic flight of an eagle. The wing spread is ample, the wing well balanced in its proportions of length and breadth, well combined to produce both power and speed. The figure is somewhat burly and chunky as compared with the lighter appearance of the gull and the more racy lines of the yager. The impression of muscularity is heightened by the short, square-cut tail, carried somewhat uptilted, giving the fowl an appearance unmistakable in the eyes of one having once recognized it. This peculiarity of tail, which to me seemed slightly forked instead of having the central feathers lengthened, as in others of this group, together with the broad white patch across the bases of the primaries, furnishes a good field mark for the identification of the species.

Macgillivray (1852) says:

> Its voice resembles that of a young gull, being sharp and shrill, and it is from the resemblance of its cry to that of the word skua or skui that it obtains its popular name.

Mr. Rich's notes state:

> Whatever the case elsewhere, on the fishing grounds this seemed a silent species. The writer heard no sound at all which he was able with certainty to trace to it during his acquaintance with it.

The most interesting phase of the skua's life history is its behavior toward other species. It is certainly a bold and dashing tyrant, more than a match for anything of its size and a terror to many birds and beasts of larger size. Mr. F. St. Mars (1912) describes its attack on the golden eagle, which dared to venture too near its nest, in the following graphic words:

> Some minutes elapsed, in spite of the warnings, before the human eye could have made out a faint dot growing out of the mist round the tail of an inlet. It enlarged rapidly, however, that dot, and one saw that it was really a real, live eagle, a golden eagle of Scotland. Mind you, there was none of that sublime soaring in the infinite that the books tell of. He came, as any mere common bird might have come, beating up along the shore with heavy, flapping flight, which, by the way, looked much slower than it really was, and he said nothing as he came.
>
> The picture, as it stood, of that somber, bronze-gold winged giant, beating slowly up against the wind in a setting of dim gray sky, jade sea, and dark-velvet land, was very fine. It seemed that nothing could have added to its bold, wild grandeur. Then something seemed to move across the heavens very quickly, and there was a hissing sound as if a mighty sword had cleaved the air. Followed then a second phenomenon just like the first, and almost in the same instant one realized two distinct facts: Firstly, that the two skuas were no longer near their nest; and, secondly, that the eagle had, with five stupendous flaps of those vast wings, shot upward into the clouds.

At the same instant it seemed as though a big brown projectile hurtled past exactly beneath him, and a fraction of a second later, as though another one had hit him. There was a burst of feathers and a whirl. The eagle appeared suddenly to grow much larger, miraculously to sprout an extra and smaller, thinner pair of wings, and to reel in his flight, recover, reel again, turn half over, as if grappling some invisible foe, drop like a thunderbolt some 200 feet, and then break into two pieces, the larger piece slanting upward on the one hand and the smaller executing the same wonderful aerial evolution on the other.

Then were the facts made plain. The smaller portion was the skua. He had darted like lightning upon the eagle's back and clung there for a second or two—only for a second or two, but it seemed minutes while the two fell—after the king had avoided his mate's first reckless, headlong, crazy rush.

I have no hope to describe to you what followed, because the laboring human eye was far too slow to see and the brain to grasp the electric-quick passage of events. I only know that one was dimly aware that some stupendous battle was going on up there in the dim northern heavens; that bodies, large bodies, bursting with life and a dozen uncurbed wild passions, were sweeping and swerving, and swooping, and swaying, and streaking, and stabbing, and slashing, and striving, and screaming in one wild welter of wildering speed. And all the while the land below, save for the huddled sheep, lay as deserted as if a hand had come down and swept it clean of life. Yet one knew that in reality hundreds and hundreds of sharp eyes were watching from cover that battle of the overlords of the air and calculating the chances of life upon its issue.

Slowly, second by furious second, inch by hard-fought inch it looked from the earth, but mile by mile it was really, up there in the unbounded airy spaces, the battle receded, receded upward and northward, till the straining eye was at last only conscious of a faraway blur, a dancing of specks, as it were gnats, on the vision, and then, with an almost audible sigh from the hidden spectators, of nothing.

Mr. Rich's impressions of the behavior of the skua are expressed in his notes as follows:

This is the overlord of the fishing grounds, fearing no bird here. Whether the skua would successfully contest with the black-backed gull the writer is unable to state, as the two did not come together under his observation, but he thinks that the skua need have little uneasiness as to the outcome of battle. The difference in size between the black back and the skua is mostly a matter of measurements, due in part, at least, to the skua's shortness of rudder. In bulk and weight there is less difference, probably, than is shown by these figures, and in physical powers, judging from appearances, there is little to choose between them. Of the two, the skua's armament seems the better fitted for damaging an enemy, and he seems to possess greater speed and skill in maneuvering—a flight of greater power and control than has his rival, who, gull-like, is a drifter rather than a flier. Certain it is that the hag, tern, kittiwake, and herring gull move respectfully aside when the "sea hen" comes sailing above them, for all these he harries and robs constantly, performing in the realms of the sea the same robber tactics which the raptorial birds carry on among the feathered people ashore. Are the hags or the gulls squabbling over a bit of waste or striving to tear a "poke-blown" fish which has drifted away from the steamer's side; over the struggling mass there comes the shadow of broad wings; a heavy body drops among them regardless of what may be beneath it; the weaker move respectfully aside and leave the newcomer in undisturbed possession of the spoil. Over his shoulder the skua gazes at the steamer, making only now and then a tentative pull at the body of his prey, until it has floated to a safe distance, when he begins to rip and tear it with his powerful beak. To lose all interest in that particular morsel, hag or gull that comes near the spoil needs to look but once at that lowered head with its bristling crest, and the powerful wing upraised to strike.

Winter.—The status of the skua as an American bird is based largely on its occurrence on the fishing banks off the coasts of Newfoundland and New England. Probably the birds which occur there in winter are of this species, but the following notes by Mr. Rich suggest the possibility that the birds seen there in summer may be of one of the Antarctic species:

> In the main, the "sea hen" seems to have been considered a winter visitor to our coasts, somewhat unusual during the summer months, yet my records show its presence here from June 19 to November 5, with its period of greatest abundance from August 12 to September 10 (this in the "South part of the channel," 35 miles east; south from Sankaty Head, 68° —42′ W.; 41° —20′ N.), with numbers diminishing thereafter until the last appearance therein noted on November 5, 1913. The writer remained upon the fishing grounds 21 days later, but did not again note its presence there.
>
> These facts have suggested to Mr. Norton that the "sea hen" of the summer months may have come from the Antarctic with the shearwaters, returning thither to breed among the penguin rookeries of that little-known continent on the underside of the world; while the skuas of the winter months may come from the northern breeding grounds of the species.
>
> It is regrettable that I was unable to collect any specimens with which to make comparisons and to go deeper into this matter. There would have been very little difficulty in getting material, as the "sea hen," while more careful than the "gull-chasers," was not very shy, and shots at 80 yards or even less would have been frequent.

DISTRIBUTION.

Breeding range.—Islands of the North Atlantic Ocean, Greenland, Iceland, the Faroe and Shetland Islands. Said by Kumlien to breed at Lady Franklin Island north of Hudson Strait.

Winter range.—The North Atlantic Ocean, occasionally reaching land. From the Great Banks, off Newfoundland, and Georges Bank, off Massachusetts, to New York (Long Island). In Europe from the British Isles and Norway south to Gibraltar. Occasional in the Mediterranean Sea and on inland waters.

Spring migration.—Migration dates in North America are so few as to appear little more than straggling records. Labrador: Straits of Belle Isle, June 22.

Fall migration.—Birds reach Georges Bank in July. Massachusetts dates: Ipswich, September 17; Woods Hole, August 30 and September 19; Pollock Rip, September 10; and Nantucket Shoals, October 17. Recorded from New York (Long Island) as early as August 10.

Casual records.—Accidental inland in New York (Niagara River, spring, 1886).

Egg dates.—Iceland: Twenty-four records May 20 to June 23; twelve records June 3 to 15. Greenland: One record June 21.

CATHARACTA CHILENSIS (Bonaparte).

CHILEAN SKUA.

HABITS.

The preceding species, *Catharacta skua*, has been reported, as a straggler, on the coasts of California and Washington, where specimens have been taken, as recorded below.

These records have always seemed open to question as it seemed unlikely that a bird of the Atlantic Ocean would stray so far away from its normal habitat.

There are at least two other species of skua, which are fairly common in certain parts of the South Pacific and South Indian Oceans, which would be much more likely to wander to the coast of California. Thinking that these records might refer to *Catharacta chilensis* or *Catharacta lonnbergi*, I opened correspondence regarding them with Mr. Harry S. Swarth, which resulted in his sending me one of the birds. After consultation with Mr. Robert Cushman Murphy, who is familiar with these species in life, and after comparing it with series of specimens of *chilensis*, *lonnbergi*, and *antarctica* in various museums in Cambridge, New York, and Washington, I have decided to provisionally refer these birds to the above species, *Catharacta chilensis*, of which they probably represent an immature plumage or a dark phase.

DISTRIBUTION.

Breeding range.—Unknown.

Range.—Most abundant on the coasts of Chile and Peru, but found on both coasts of southern South America, from Rio Janeiro, on the Atlantic side, to Callao, Peru, on the Pacific side. Wanders northward, perhaps regularly, in the Pacific Ocean to Japan (Sagami Sea, August 23, 1903), California (Monterey Bay, August 7, 1907, and August 4 and September 21, 1910), Washington (off Gray's Harbor, June 28, 1917), and British Columbia (off Vancouver Island, June 20, 1917).

STERCORARIUS POMARINUS (Temminck).

POMARINE JAEGER.

HABITS.

To most of us this and the other jaegers are known only as summer and fall visitors on our coasts or on the fishing banks, where they are constantly harassing the smaller gulls, the terns, and the shearwaters, from whom they obtain by force a large part of their food supply. The pomarine is the largest of the three, but by no means the most aggressive. Few of us have ever seen it on its breeding grounds, which lie within the Arctic Circle, where it is widely scattered over the boundless plains of the marshy tundra.

Spring.—Dr. E. W. Nelson (1887) says of its arrival in northern Alaska:

> The earliest arrival of this bird in spring was May 18 at the Yukon mouth where the writer found it searching for food along the ice-covered river channels. They became more common, until, by the last of the month, from a dozen to 20 might be seen every day,

Mr. Frank C. Hennessey, who accompanied the A. P. Low expedition to the regions north of Hudson Bay, says, in his notes, that "the first of this variety was seen to arrive in the spring at Winter Harbour on May 29th."

Nesting.—Very little has been published on the nesting habits of the pomarine jaeger. Mr. Hennessey, in the notes referred to above, which he kindly sent me, states that these birds are "abundant about Winter Harbour, where they breed on the low, flat, marshy land in the neighborhood, choosing the small mounds or slight elevations that abound in these places upon which to rear their brood. The nest is a slight depression in the soil of the elevation and just deep enough to admit the eggs and breast of the bird. No material is used in its construction, but the bottom is covered with much loose soil and rubbish apparently blown in accidentally." Mr. C. Boyce Hill (1900) published the following account of the nesting habits of this species in Siberia:

> On our way down the Yenisei the steamer which was towing us fortunately ran ashore on one of the numerous sand banks which abound in this river. I say fortunately because it enabled us to discover this skua nesting. After having inquired the probable duration of our stoppage, Popan and I agreed to explore the small islands near at hand—a group named the Brekotsky. We took one each, and on mine, a large, flat marsh, I observed a Pomatorhine skua, which was presently joined by another. The birds did not appear at all demonstrative nor to resent intrusion, like the long-tailed skuas, so I thought they could not be nesting. But after much searching and watching I observed one settle right in the center of the marsh, so at once proceeded to the spot. The bird rose when I was within a few yards of it, and to my delight I saw the nest with two eggs. I waited a few moments for the skua to come within shot and killed it; after pursuing its mate, I captured that also. The nest was a mere depression in the ground, on a spot rather drier than the surrounding marsh, and to reach it I was at times up to my knees in swamp; so that had it not been for a foundation of ice at a depth of from 18 inches to 2 feet from the surface I do not think I should have been able to record this event. I also found nesting on this island some scaup ducks and red-necked phalaropes.

Mr. Ludwig Kumlien (1879) found this species breeding on the Greenland coast under very different conditions. He writes:

> I have, however, nowhere found them so very common as on the southern shores of Disko Island; at Laxbught and Fortuna Bay there must have been

many hundred pairs nesting. Their breeding place was an inaccessible cliff about half a mile from the seashore. The greater number of the birds nesting here were in the plumage described in Doctor Coues's monograph of the Laridae as the nearly adult plumage; but there were also a good many birds that were unicolored blackish brown all over, but with the long vertically twisted tail feathers. That these were breeding I think there can be no doubt, as I saw them carrying food up to the ledges on the cliff, for the young I suppose.

Eggs.—The Pomarine jaeger lays two or three eggs to a set, usually the former. They are said to be scarcely distinguishable from certain eggs of the parasitic jaeger or of the mew gull, but are more pointed. The shape is ovate or pointed ovate. The shell is smooth and slightly glossy. The ground color varies from "brownish olive" or "Brussels brown" to "olive lake" or "dark olive buff." They are rather sparingly spotted with "bone brown," "bister," "chestnut brown," or "snuff brown," and occasionally with underlying spots or blotches of various shades of drab or gray. The measurements of 49 eggs, in various collections, average 62 by 44 millimeters; the eggs showing the four extremes measure 72.6 by 44.9, 68 by 48, 57.2 by 43.6, and 58.5 by 40 millimeters.

Plumages.—The young when first hatched is covered with long soft down, of plain colors and unspotted; the upper parts are "clove brown" or "olive brown" and the under parts "drab" or "light drab." The plumage appears first on the scapulars, back, and wings, then on the breast, and the full juvenal plumage, which is not distinctly separated from the first winter, is acquired before the young bird is fully grown. The first winter plumage is the well-known brownish mottled plumage, in which the body feathers and particularly the scapulars are heavily barred transversely with dark browns or dusky tints and tipped with rufous or pinkish buff; the central tail feathers are only slightly elongated beyond the other rectrices. This plumage is worn with slight changes all through the first year, or until the first postnuptial molt, which begins in June and lasts until October. The rufous or buff edgings gradually fade out to white during the winter; during the molt into the second-year plumage August birds show old barred feathers with white edgings and new barred feathers with rufous edgings. The second winter plumage is still mottled or barred, but is much lighter colored; the browns are grayer and there is more white, the rufous edgings soon disappearing. There is less barring on the under parts and the belly is often wholly white centrally; the under tail-coverts are heavily barred with white and dusky. There are sometimes signs of the golden collar in this plumage. If there is any molt in the spring, it is only partial, and probably the young bird does not breed in this plumage the second spring.

At the second postnuptial molt the following summer, when the bird is about 2 years old, the third-year plumage is assumed. This plumage is practically the same as the adult in many individuals; the upper parts are uniformly dark, except that the white and golden collar encircles the neck; the two central tail feathers become much elongated; the under parts are mainly white, with more or less dusky mottling on the neck, upper breast, and sides; and the lower abdomen and under tail-coverts become dusky, but in some individuals these are veiled or mixed, more or less, with white. There is great individual variation in the amount and extent of the dusky mottling in the white areas, in the amount of white in the dark under tail-coverts, and in the extent of the white and golden collar at this age; but as there is not much further progress to be made toward maturity, the third-year birds may be considered practically adult. The fully adult plumage, without much mottling in either the light or the dark areas and with the fully developed golden collar, increases in perfection with subsequent molts; the clear dark crissum and under tail-coverts are assumed when the bird is about 3 years old, though vigorous birds may acquire them before that time. I have never seen a specimen in which the neck, breast, and shoulders were *entirely* free from dusky mottling.

Birds in the dark phase of plumage, apparently, undergo the same sequence of plumages to maturity, though I have not been able to trace the changes so satisfactorily. In the first-year plumage they are much darker than in the light phase, with the white barring much more restricted. During the second year they are almost wholly dark with some whitish and rufous edgings above and below. The third-year and adult plumages are hardly distinguishable, both being uniformly dark, but some specimens show an indication of the golden collar, more or less distinctly, which are probably the older birds. The molt of the contour feathers in both phases occurs in summer, from June to October, and the flight feathers are molted in October, beginning with the inner primaries and the central rectrices. The prenuptial molts of both young birds and adults are probably incomplete, but specimens of winter and early spring birds are too scarce to demonstrate it.

Food.—The predatory feeding habits of the jaegers are familiar to everyone who has studied the habits of our sea birds during the latter part of summer and fall. They are the notorious pirates and freebooters among sea birds, the highwaymen that persecute their neighbors on the fishing grounds and make them "stand and deliver." It is no uncommon sight on the New England coast to see one or two of these dusky robbers darting through a flock of hovering terns or small gulls, or giving chase to the lucky one that has caught a fish, following every twist and turn in its hurrying flight as it tries to dodge or escape, close at its heels as if attached by an invisible string. At last, in desperation, the harassed tern drops its fish and the relentless pursuer seizes it before it strikes the water. Occasionally the indignant tern voids its excrement instead, which the jaeger immediately seizes, as if it were a dainty morsel.

Off Chatham, Massachusetts, we often saw this and the next species, which are called "jiddie-hawks" by the fishermen, mingling with the shearwaters and browbeating them as they do the gulls and terns. As soon as the shearwaters began to gather about our boat to pick up the pieces of cod liver that we threw overboard, the jaegers would appear and take a hand in the general scramble for food. They are quick to sense the idea that a gathering flock of sea birds means a feast to be obtained by force. The "haglets" are greedy feeders, and soon gulp down what pieces of food they can find, but they have learned by many a painful squabble that they are no match for the active, fighting "jiddie-hawks," and they are soon forced to disgorge or to surrender the field.

Mr. Kumlien (1879) says that on the Greenland coast "they live to a great extent upon the labors of the kittiwake, though they do not hesitate to attack *Larus leucopterus*, and even *glaucus*. They are destructive to young birds and eggs. It is a common sight to see five or six after one gull, which is soon made to disgorge, and then the jaegers fight among themselves for the morsel, which often gets lost in the mêlée." In addition to the food stolen from other birds, the pomarine jaeger lives on what it can pick up in the way of offal, carrion, and scraps thrown from the galley. It devours young birds and eggs, and even small mammals, such as mice and lemmings.

Mr. Albert W. Tuttle (1911) publishes the following account, contained in a letter from Mr. Allen Moses, of Grand Manan, New Brunswick:

> I saw a pomarine jaeger catch a phalarope. There was a pair of the jaegers. The female started after the phalaropes and chased them a long time. They were too smart for her, and after a long chase she separated out one, and then the male gave chase, and in a few minutes, with the two chasing the little fellow, one caught him within a hundred yards of the vessel; then they both lighted in the water and ate him.

Behavior.—Were it not endowed with splendid powers of flight the pomarine jaeger could never perform the feats indicated above. It is not only swift and powerful, but it has wonderful command of its powers on the wing. It can be easily recognized by its superior size and by the peculiar shape of its elongated, central tail feathers, which are broad and blunt and are held with their vanes in a vertical plane, like a rudder. Its ordinary flight is steady and direct, with rather slow, constant wing beats. Mr. Walter H. Rich has contributed the following notes on one of its spectacular performances:

> On several occasions I have seen the "gull chaser" turn a complete back somersault in the air to make a dive upon some piece of food on the water which the sweeping gale had caused it to overrun. Often, too, it thus makes its piratical raids upon some luckless hag, which, almost too late, it finds in possession of a morsel which it deems too dainty to be wasted on a mere squealing shearwater. And so it rises against the breeze, turns itself upside down and, with wings half closed, darts at its victim from above like a lance. But the hag stands to his guns; a squealing, choking remonstrance, a mighty gulp, and if the jaeger has luck he may capture a small fragment of the spoil.

Mr. Rich says that the usual "call is a sharp 'which-yew,' also a squeaky whistle, and occasionally a squealing note like the 'week-week' of the herring gull." Doctor Nelson (1887) says that it "has a low, harsh, chattering cry when feeding with its companions."

Its behavior toward other species, which has been partially shown above, is not above criticism; its motto seems to be that might makes right; it therefore uses some discretion in the choice of victims for persecution. The terns and the kittiwakes are the ones most regularly abused, the ring-billed and the herring gulls are less frequently persecuted, and it seldom ventures to attack the glaucous or the great black-backed gulls. Size and strength do not always bring courage, and the pomarine jaeger seems to be lacking in the latter quality. Doctor Nelson (1887) writes:

> They are clumsy and cowardly as compared with their smaller relatives. When one of this species chances to cross the path of the smaller species, the latter almost invariably gives chase and beats its clumsy antagonist off the field by repeatedly darting down from above. This attack embarrasses the large bird, so that it flinches and dives and often alights and watches an opportunity to escape from its nimble assailant. One that was driven to alight in the river thrust its head under water at every swoop of its assailant and exhibited the most ludicrous terror. When on the wing they usually ward off an attack from one side by a half-closed wing, and if above, both wings are raised, forming an arched shield above the back.

Fall.—The fall migration of the jaegers is governed largely by the food supply, which depends on the movements of the fish on which the gulls, terns, and shearwaters feed. On the New England coast we usually look for the jaegers in August, especially where the bluefish or mackerel are running in schools and driving the small fry to the surface. During seasons when these fish are scarce the jaegers and shearwaters are absent, perhaps following other schools of fish far out at sea. And when the bluefish and mackerel move off the coast in the fall the jaegers disappear with them. They are seldom seen on our coasts in winter. We do not know very much about their winter range and habits, but they probably spend this season roaming at large over the open ocean wherever they can find a chance to ply their trade as pelagic pirates.

DISTRIBUTION.

Breeding range.—Northern parts of the Northern Hemisphere. In North America east to central Greenland (latitude 64° to 73° N.). South to Cumberland (Exeter Sound) and Hall Peninsula (Grinnell Bay), Melville Peninsula (Winter Harbor), and the Arctic coast of North America. West to northwestern Alaska (Kotzebue Sound to Point Barrow. North to Melville Island, Banks Island, North Somerset, and probably others of the Arctic islands. In Europe from Iceland to Spitzbergen, and Nova Zembla, perhaps occasionally on the coast of northern Norway; also in northeastern Siberia and probably the entire Siberian coast. Siberian birds have been described as a distinct subspecies, but it is doubtful if on good grounds.

Winter range.—Poorly defined. Probably in Southern Hemisphere south to Peru (Callao Bay), northern Australia (Cape York), Burma, and South Africa (Walfisch Bay); also said to occur on inland waters of Europe south to the Mediterranean, and in small numbers from the coast of southern California to the Galapagos; occasional in winter in the Orkney Islands, off the south coast of England, and off Japan. It seems probable that these more northern records are not true wintering birds, but late migrants or stragglers.

Spring migration.—Northward off both coasts of North America. Early dates of arrival: North Carolina, Cape Hatteras, April 18; Massachusetts, May 23; Maine, May 29; New Brunswick, Grand Manan, May 26; Melville Peninsula, Winter Harbor, May 29; Greenland, June 10; California, San Francisco Bay, May 5; Alaska, St. Michael, May 23, and Point Barrow, May 23 to June 6; northeastern Siberia, Liakoff Islands, June 20.

Fall migration.—Southward by same routes. Early dates of arrival: Newfoundland, Bonne Bay, August 16; Nova Scotia, Sable Island, September 3; Rhode Island, September 13; New Jersey, October; Alaska, Kodiak Island, August 15; Washington, Puget Sound, September 7; California, Monterey Bay, August 2; Mexican coast, October 5; Peru, Callao Bay, November 17. Late dates of departure: Northeastern Greenland, latitude 75° 49′ N., August 6; western Greenland, Disco Island, September 6; Nova Scotia, Halifax, October 4; Maine, late October; Massachusetts, December 9; Rhode Island, October 11; New York, Long Island, October 30; New Jersey, December; Alaska, Point Barrow, August 15 to September 20; Washington, Puget Sound, October 22; California, Monterey Bay, October 27.

Casual records.—Spring records from Nebraska and Michigan and fall records from Pennsylvania, Ohio, Illinois, and Missouri are probably casual stragglers, but they may indicate a limited migration through the interior from Hudson Bay.

Egg dates.—Point Barrow, Alaska: Twenty-four records June 12 to 27; twelve records June 17 to 20. Iceland: Three records May 21, June 1 and 28.

STERCORARIUS PARASITICUS (Linnaeus).

PARASITIC JAEGER.

HABITS.

Contributed by Charles Wendell Townsend.

As one watches a flock of terns whirling like driven snow, now here, now there, and ever and anon plunging for fish, one may sometimes see a dark, hawk-like bird suddenly appear on the scene and spread devastation in the ranks. With relentless energy he singles out and pursues some hapless individual until it drops its prey. This is a jaeger, a gull-like bird, with hawk-like characteristics. A more appropriate name for him would be robber rather than jaeger or hunter, for he obtains his food by robbing other birds. He has, however, all the grace and agility of the true hunting birds—the hawks—but his actions rarely end in bloodshed. After all robbery is a less serious crime than murder, but the term robber is opprobrious, while that of hunter is not, so it is perhaps well that the name remains as it is.

The parasitic jaeger is circumpolar in its distribution and breeds throughout the barren arctic grounds in North America, Greenland, Europe, and Asia. In Europe it nests as far south as the Shetlands. It winters from the southern part of its summer range along the coast even as far as Brazil, Australia, and the Cape of Good Hope, but in the interior of the continents it is only of casual occurence.

Spring.—In the brief arctic spring, when the ice is breaking up and the snowdrifts are dwindling, the parasitic jaeger arrives on the breeding grounds on the tundra near the shores of the Arctic Ocean, or at a distance from the sea on the shores of ponds or lakes. It generally nests apart, not in communities. Of its courtship nothing is known. It is possible that the "wailing cries" described by Nelson and mentioned later may be in the nature of the love song. When surprised near the nest, Nelson (1887) says, "it creeps along the ground with flapping wings to decoy away the intruder."

Nesting.—The nest is a mere depression in the soil. Macfarlane (1908) says it is "scantily lined with a few withered leaves and grasses." Grinnell (1900) in the region of Kotzebue Sound, Alaska, says "the nest was a slight saucer-shaped depression on a low mossy hummock on the tundra. This depression was scatteringly lined with bits of white lichen, such as grow immediately around the nest." Thayer and Bangs (1914) report that Koren found it in

Kolyma Delta, Siberia. J. Koren.

Point Barrow, Alaska. T. L. Richardson.

PARASITIC JAEGER.

FOR DESCRIPTION SEE PAGE 329.

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northern Siberia nesting "in dry spots in swamps." Russell (1898) at the mouth of the Mackenzie, says that "the nest was simply a level bit of dry moss on the tundra a few yards from the water's edge."

Eggs.—Only two eggs are laid and one brood hatched. Nelson (1887) says the eggs are laid in northern Alaska by June 5. The egg is ovate in shape, of a dull olive varying to green, gray or brown ground color, with spots, blotches, and lines of a sepia, drab, dark chocolate, and umber-vinaceous color. These markings are sometimes distributed with great uniformity over the whole egg or gathered as a wreath about the larger end. The measurements of 50 eggs in various collections average 57 by 41 millimeters; the eggs showing the four extremes measure **61** by 41, 58 by **43**, **51** by 40.5, and 56 by **38** millimeters.

Plumages.—[Author's note: I have never seen a small specimen of the downy young of the parasitic jaeger, but a half-grown young in my collection, which is still more than half downy, has the down of the upper parts uniform "natal brown," paler on the head and neck, and shading off to "drab-gray" on the under parts. There is no indication of any mottling anywhere. The juvenal plumage is well advanced on the wings and scapulars, where it evidently appears first; the feathers are appearing through the down all over the breast and belly and on the upper part of the back; the tail feathers are bursting their sheaths.

The sequence of plumages to maturity is practically the same, in both phases, as in the pomarine jaeger, except that the parasitic jaeger normally acquires its fully adult plumage when a little over 2 years old. The first-year plumage is heavily barred above and below with rufous edgings, which fade and wear away during the fall and winter. The second-year plumage is less heavily barred, with narrower and whitish edgings above, with much more white in the underparts, with heavily barred under tail-coverts, with somewhat elongated central rectrices and sometimes with a suggestion of the golden color. At the second postnuptial molt, when the bird is from 25 to 27 months old, the fully adult plumage is assumed with no mottling or barring anywhere, with the dusky under tail-coverts and crissum and with the elongated central rectrices.

During this molt the upper body plumage is completed first, and the last signs of immaturity to disappear are the barred feathers of the chest and flanks. The postnuptial molt of both adults and young is complete and occurs in August, September, and October, the wings being molted in October. There is probably an incomplete prenuptial molt also, but material is lacking to show it satisfactorily. Fall adults in fresh plumage have the chin, throat, and neck clouded with light drab and the dark crown less pronounced than in spring. This disappears partially by wear, but I have seen one adult, taken in California on April 29, in which this plumage was being replaced by a partial molt.

Adult parasitic jaegers can be distinguished in life at a long distance by the downward extension of the drab mantle on the sides of the neck which seems to form a partial collar; this is entirely absent in the long-tailed jaeger; the long central tail feathers are more pointed and are held differently in flight from those of the pomarine jaeger, as explained under that species; these feathers are, however, an unsafe guide by which to distinguish the parasitic and long-tailed jaegers, as there is much individual variation and overlapping. These last two species can hardly be distinguished in life in the immature plumages. For the best characters by which they can be distinguished in the hand I would refer the reader to Dr. Leonhard Stejneger's (1885) excellent remarks on the subject.

In the dark phase, which may prove to be a distinct species, the sequence of molts and plumages is practically the same as outlined above, though the birds are much darker in all stages. During the first year the brown edgings are conspicuous, but during the second they are replaced by narrower and whiter edgings, the under tail-coverts being heavily barred in both cases. The adult plumage is wholly sooty, with sometimes a trace of the golden collar.]

The proportions of the two phases vary considerably. At Ipswich in the migrations, which extend over most of the summer, the birds in light phase outnumber the dark birds in the proportion of 8 or 10 to 1. On the Labrador coast I found those in the dark phase more numerous in proportion than at Ipswich. Richardson (1825) says that on the banks of the Coppermine River in the beginning of July the greater part of them had dark abdomens. Grinnell (1900) in Alaska found a sooty bird mated with a light one and remarks that "one could scarcely believe them to be of the same species." He says that half of this species in June and July were in the dark plumage. Thayer and Bangs (1914) mention two pairs in northern Siberia, where all four birds were in the light phase, and one pair at Kodiak Island, Alaska, where the birds were in the dark phase. Nelson (1887) mentioned a similar dark couple. The difference between the two phases seems as great as that between the greater and the sooty shearwaters.

Food.—The feeding habits of the parasitic jaeger vary considerably with the locality. The host on which it preys is in some places, as on the New England coast, the common tern, although the arctic, roseate, and least terns, as well as the Bonaparte's gull, may in places be added. On the eastern Labrador coast I found the great flocks of kittiwakes to be the chief source of its supplies, as also is the case in Baffin's Land, for Kumlien (1879) says:

> This species seems to depend on *Rissa tridactyla* for the greater part of its food.

Anderson (1913), under the heading "Parasitic jaeger," says:

> The jaegers are the terror of the smaller birds, spending their time ceaselessly hawking back and forth over the tundra looking for eggs and young birds. Large numbers of eggs of elders and gulls are destroyed in the rookeries by the jaegers. Whenever the Arctic terns are nesting their neighbors are comparatively safe, as the belligerent little terns speedily cause any marauding jaeger to beat a hasty retreat. I have also seen ruddy turnstones drive a jaeger away from the nests. I once observed a pair of jaegers chasing a flock of sandpipers. One sandpiper flew out of the flock, the jaegers in pursuit. They seemed to work together, one darting in while the other turned. The sandpiper finally escaped by flying upward until almost out of sight, and the jaegers finally gave up the chase. * * * Some other birds will also attack the jaegers, which are really cowardly birds when heartily opposed. I have on two or three occasions seen a rock ptarmigan fly fiercely at a jaeger which came too near his nesting place and put the jaeger to ignominious flight.

Its calling makes it one of the most interesting sea birds to watch. The advent of a jaeger among a flock of terns occasions loud cries of anger among the latter as they scatter to the right and left, while the hunter, singling out one individual, chases it with great energy. No matter how skillfully and rapidly the victim twists and turns, now up, now down, now to one side, now the other, sooner or later, with a few exceptions, it acknowledges defeat by dropping the fish from its beak or by disgorging the contents of its gullet. These, the jaeger, with great skill and agility, catches in mid-air and swallows at once, or on other occasions carries hanging from the beak for a short distance before satisfying its appetite. Sometimes it alights on the water, the better to enjoy its meal. Nelson (1887) says:

> They are very greedy, and frequently swallow so much that they are unable to fly until a portion is disgorged.

The victimized tern meanwhile vents its wrath at the robbery in no uncertain language and must again set to work for its living. But the jaegers are not always successful. Thus, on one occasion, I saw a parasitic jaeger pursue a common tern in a straight line for nearly a mile, eventually to give up the chase. Not infrequently two hunters combine on one victim. Thus I have notes of two jaegers at Ipswich, one in the dark, the other in the light phase, that relentlessly followed a common tern. The bird that secured the prize was at once pursued by his companion and accessory in theft. On another occasion two jaegers at Ipswich were chasing a tern that twisted in sharp angles and small circles over the beach

Finally the tern dropped the fish, which one of the jaegers secured in mid-air. Later the two dashed into a flock of about a hundred terns and chased them right and left. The terns screamed and darted around in great confusion; some retaliated by chasing the jaegers.

Although this bird well justifies its name *parasitic*, it occasionally does some foraging for itself; thus King (1836) says that it also "subsists on putrid fish and other animal substances thrown up by the sea." Turner (1886), at St. Michael, Alaska, says it eats "fishes that had been cast on the beach, shell fish, and other animal food. They also eat the berries of *Empetrùm nigrum*." The latter is the crow berry or the curlew berry of the north, the berry on which the curlew formerly fatted in countless numbers. Turner also relates an instance where a parasitic jaeger picked up a freshly torn-off muskrat skin that was floating on the surface of the water.

> It seized the skin in its beak and then passed it to its claws, by which it carried it off a little distance and began to strip the adhering muscle and fat from it.

Nelson (1887) reported that this species eats also shrews, mice, and lemmings. Eifrig (1905) found bones and feathers in the stomachs. Seton (1908) says that in the region of the lakes of the barren grounds "it lives much like a hawk or a raven, coming when a caribou is killed to share in the oflal. Once saw one capture a Lapland longspur on the wing, and have often seen it pursuing ground squirrels." Preble (1908) gives the stomach contents of two taken near the Great Slave Lake; the first contained various insects and the bones of a small bird, evidently a young tern, and the other a dragon fly, various beetles, and a small fish. Anthony (1906) says:

> These deep-sea individuals had their stomachs filled to overflowing with fish spawn about the size of No. 5 shot, evidently of some species spawning on the surface where the bird could pick it up without trouble. I have seen this jaeger in Bering Straits diving for surf smelt, together with Pacific kittiwakes; but, like all of their group, they found it difficult to get below the surface, even with the help of a drop of 6 or 8 feet above the water, and seldom neglected an opportunity to rob the Arctic tern or kittiwake.

Behavior.—The flight, swimming, and diving of this species have all been mentioned in the feeding habits. While the first is rapid, graceful, and falcon-like, the two last are seldom indulged in, and not very efficient. It is, indeed, a bird of the air and outside of the breeding grounds is rarely seen on shore. On one occasion, however, at Ipswich, I saw a flock of 10 of these birds on the smooth, hard beach.

In the chase of terns, it is the tern that uses its vocal powers, and the voice of the jaeger is rarely heard. Nelson (1887) says:

> On cloudy days or in the dusky twilight, these birds have a habit of uttering loud wailing cries, interspersed with harsh shrieks, which are among the most peculiar notes heard in the northern breeding grounds.

Mr. W. Elmer Ekblaw says of the habits of this jaeger in Greenland:

> The jaeger not only steals the food away from the other birds, but also preys upon their eggs and young. In 1914 I found in one day's tramp two eider nests and one nest of the ring-necked plover that had been despoiled by this ravager. The pierced egg shells were scattered about the nests, as if the jaeger had delighted in the destruction he had wrought. The knots and sandpipers of the land birds and the kittiwakes and terns of the sea birds cordially hate the jaeger. In protection of their nests and young these birds often valiantly attack and drive off the greedy jaeger, but usually he pursues them vindictively until they yield to him. He is the particular enemy of the kittiwakes, and whenever he dashes into a flock of them his vicious screams scatter them panic stricken. He then singles out one for his victim and pursues him relentlessly with buteonine tenacity of purpose.

Disliked, as parasitic jaegers must be by their victims, they are well able to take care of themselves and have few destructive enemies. Even man, although eagerly taking the eggs for food on the breeding grounds, disdains to eat the robber bird. It may, like the strongest of sea birds, at times succumb to the tempest. King (1836) records that one in a storm "sought refuge from the raging elements under the lee of our tent."

Fall.—The fall migration of the young of the year begins in Alaska, according to Nelson (1887), after the 20th of September and the birds keep out to sea on the New England coast. I have seen adults at Ipswich as early as July. Here they pursue their calling among the terns until these birds leave for the south, whither they follow them by September, and continue the same methods of making a living during the winter.

DISTRIBUTION.

Breeding range.—Arctic and subarctic regions of both hemispheres. In North America east to Greenland (Disco Bay and Baffins Bay and probably north to Thank God Harbor. South to northern Labrador (Killinek), and northern Hudson Bay (Southampton Island), central Keewatin (near York Factory), southern Mackenzie (Great Slave Lake), southwestern Alaska (Alaska Peninsula and Kodiak Island), and the Aleutian Islands. West to Bering Sea coast of Alaska. North to the Arctic coast of Alaska and Mackenzie, also Banks Land (Mercy Bay), Melville Island (Winter Harbor), and other Arctic Islands to about 80° north latitude. Has been recorded in summer in southeastern Alaska (Glacier Bay) and may occasionally breed. In the Old World breeds from Iceland, the Faroe Islands, northern British Isles (north coast Scotland, Orkney, and Shetland Islands, and many of the Hebrides), along the Arctic coast and islands of Europe and Asia to northeastern Siberia. South to the Commander Islands and probably the Kurile Islands.

Breeding grounds protected in the following national reservation in Alaska: Aleutian Islands (as Agattu, Amchitka, and Kiska).

Winter range.—From Florida (Gulf coast) and southern California (Point Concepcion) southward along both coasts of South America to Argentina (Mar del Plata) and Chile (Valparaiso) and occasionally as far as the Straits of Magellan. In the Eastern Hemisphere along the western coast of Europe and Africa to the Cape of Good Hope; also southwestern Asia from the Persian Gulf to the Mekran and Sind coasts, and occasionally New Zealand and Australia.

Spring migration.—Northward along both coasts. Early dates of arrival: Off Jacksonville, Florida, April 9; New Jersey, Stone Harbor, May 27; Massachusetts, May 24 and 31; Greenland, Thank God Harbor, June 14; Washington, Tacoma, May 17; Alaska, St. Michael, May 7; Point Barrow, May 29; Banks Land, May 31; Mackenzie River, June 8. Late dates of departure: Straits of Magellan, March 6; Chile, Valparaiso, March 28; Florida, Matanzas Inlet, May 18; Pennsylvania, Renova, June 18; Ontario, Toronto, June 20; southern Labrador, June 21.

Fall migration.—Southward along both coasts and irregularly in the interior. Early dates of arrival: Nova Scotia, Sable Island, September 9; New Hampshire, Seabrook, September 2; Massachusetts, August 30; Rhode Island, September 2; New York, Long Island, August 6; Brazil, October 26; Argentina, Mar del Plata, October 9; southern Alaska, Cook Inlet, August 22; Washington, Puget Sound, September 2; Chile, Valparaiso, November 6. Late dates of departure: Ontario, October 20; Massachusetts, October 22; Rhode Island, November 27; South Carolina, Charleston, November; Wellington Channel, September 2; Alaska, Point Barrow, September 9, and St. Michael, September 16; Pribilof Islands, October 18; Washington, Puget Sound, November 8; California, Monterey Bay, December 12.

Casual records.—Fall records from the interior are so numerous that they indicate a regular migration route in limited numbers.

Egg dates.—Iceland: Sixteen records, May 21 to June 24; eight records, May 26 to June 14. Northern Canada: Twelve records, June 10 to July 8; six records, June 29 to July 8. Northern Alaska: Four records, June 19 and 20 and July 10 and 18. Shetland Islands: five records, May 15 to June 26; three records, May 30 to June 15.

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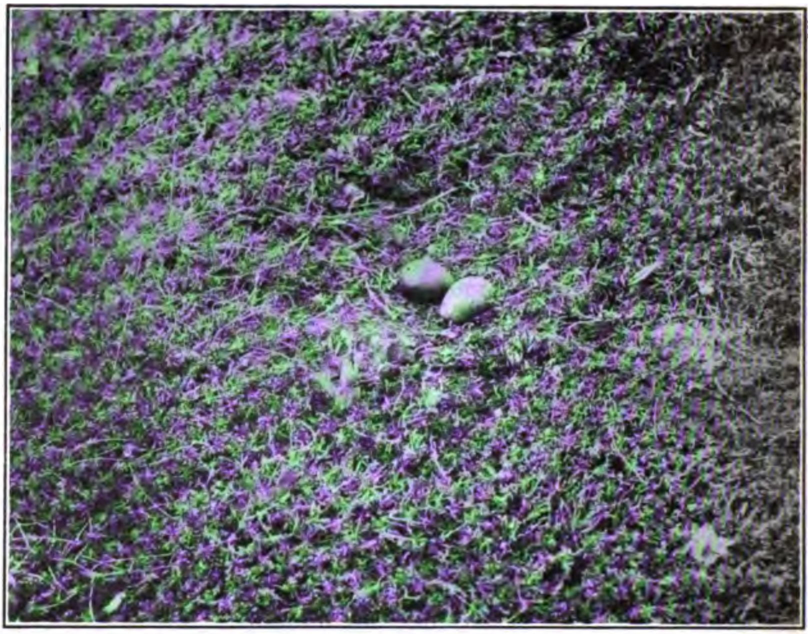
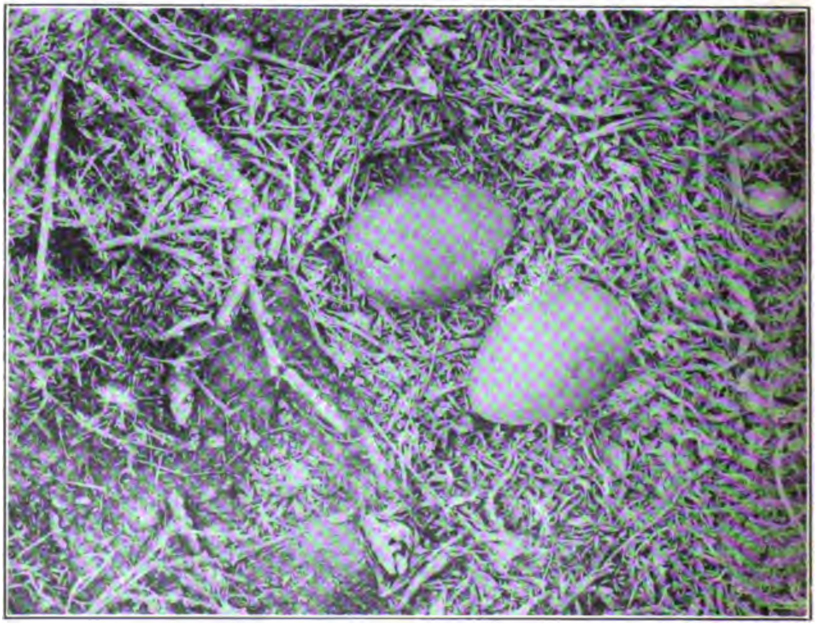


St. Michael, Alaska. F. S. Hersey.



St. Michael, Alaska. **F. S. Hersey.**

LONG-TAILED JAEGER.

FOR DESCRIPTION SEE PAGE 329

STERCORARIUS LONGICAUDUS Vieillot.

LONG-TAILED JAEGER.

HABITS.

On the rolling Arctic plains or tundra back of Nome, Alaska, we found these handsome birds very common and a conspicuous feature in the landscape, where they had probably reared their young and were spending the summer in congenial surroundings. Some of them were almost constantly in sight, and it was a pleasure to watch their graceful evolutions on the wing, as they coursed about the grassy borders of the little tundra ponds in search of food or perched on the little mossy hummocks to rest or to watch for passing birds that they might rob, or for some small mammal on which they might pounce. Certain of these little mounds seemed to be favorite lookout points for certain individuals or pairs, as there were signs of continued occupancy, and we frequently saw the same mound occupied at various times; perhaps each pair of birds has a sort of feudal domain of its own, from which intruders are driven away.

Spring.—The long-tailed jaeger retires to its Arctic summer home very early in the season and arrives on its breeding grounds in advance of its congeners. Dr. E. W. Nelson (1887) says that it arrives in the vicinity of St. Michael about May 12 or 15, but is not numerous until 10 days or more later. Mr. Lucien M. Turner (1886) writes:

> On their first arrival they are somewhat gregarious, though this may be due to the limited portions of ground free from snow. At this time the little pools of the low ground are being rapidly thawed out; many cracks in the heaving sea ice expose the water to view. These places are then scanned for food. When the ice in the lakes and larger ponds is melted, these birds usually are hovering in the vicinity, or seated on some knoll watching a gull or tern dive for a fish.

Nesting.—Doctor Nelson (1887) says of the nesting habits of this species near St. Michael:

> The mating occurs with a great amount of noisy demonstration on the part of several rivals, but once paired the birds keep by themselves, and early in June deposit their eggs in a depression on the mossy top of some knoll upon rising ground. In one instance, on June 16, while I was securing the eggs of a *Macrorhamphus*, a pair of these jaegers kept circling about, uttering harsh screams and darting down within a few feet. As I approached the spot where the snipe's eggs lay I had noticed these birds on a knoll just beyond, but had paid no attention; but as the birds kept leaving me to hover over the knoll and then return to the attack, I examined the spot, and there, in a cup-shaped depression in the moss, lay two dark greenish eggs marked with an abundance of spots. During the breeding season these birds and the preceding species have a cunning habit of tolling one away from their nest by dragging themselves along the ground and feigning the greatest suffering. They roll about among the tussocks, beat their wings, stagger from side to side, and seem to

be unable to fly, but they manage to increase the distance from their starting point at a very respectable rate, and ere long suddenly launch forth on the wing.

Mr. Hersey found a nest of the long-tailed jaeger, with two eggs on the point of hatching, near St. Michael on June 19, 1915. The eggs were laid in a natural depression of irregular shape on the top of a dry mound slightly raised above the surrounding wet tundra; there were several higher mounds within a few yards. The female could be plainly seen sitting on her nest from a considerable distance. She allowed him to approach within 20 yards before she flew, when both she and the male swooped about his head. Within 50 feet of this nest a willow ptarmigan was sitting on her nest with six eggs.

Mr. Johan Koren, according to Messrs. Thayer and Bangs (1914), found a remarkable nest of this species, in northeastern Siberia, on June 22, 1912.

> The eggs lay in a slight depression on the level, mossy ground in a dry, high, larch forest. Both parent birds were present, and both had acquired the habit of alighting and perching in the tree tops.

This was a decided exception to the rule, however, as the nest is usually placed on some slight elevation on the flat or rolling open tundra, where a few pieces of dry grass, bits of mosses or leaves are scraped together in a slight hollow. The birds are very courageous in the defense of the nest, swooping down at the intruder or flying straight at his face and turning or rising just in time to miss striking him. After the young are hatched, however, they become more cautious and seldom approach within gunshot, lest they betray the presence of the young, which are cleverly hidden in the grass.

Eggs.—The long-tailed jaeger lays almost invariably two eggs, occasionally only one, and very rarely three. The eggs are almost indistinguishable from those of the parasitic jaeger, but they average slightly smaller and are usually a little more blunt in shape. The shape varies from ovate to short ovate, usually nearer the latter. The shell is smooth and thin, but has very little luster. The ground color varies from "light brownish olive" or "Dresden brown," in the darkest eggs, to "tawny olive," "Isabella color," "light yellowish olive," or even "olive buff," in the lightest eggs. The eggs are irregularly spotted or blotched, chiefly about the larger end with "raw umber," "Prout's brown," or other lighter shades of brown. Often there are also numerous underlying spots and blotches of various shades of drab. The measurements of 48 eggs in the United States National Museum collection, average 55 by 39 millimeters; the eggs showing the four extremes measure **61.5** by **42.5**, 56 by **50**, **47** by 38.5, and 49.5 by **36** millimeters.

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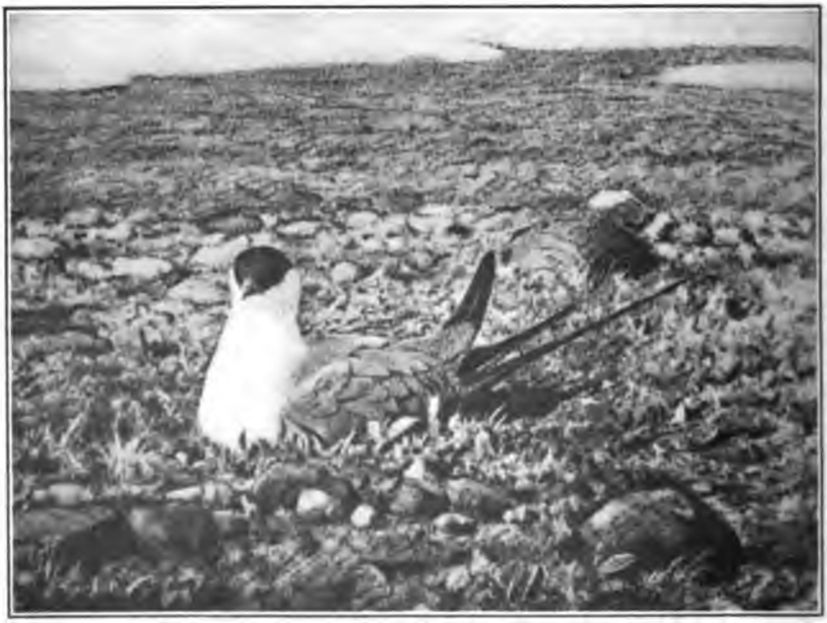
Kolyma Delta, Siberia. J. Koren.



Northeast Greenland. A. L. V. Manniche.

LONG-TAILED JAEGER.

FOR DESCRIPTION SEE PAGE 328.

The period of incubation is 23 days. Both sexes incubate. Mr. A. L. V. Manniche (1910) writes:

> As far as I could notice the sexes divided the breeding duties evenly between themselves. The posture of the bird while brooding is high, the neck and head erected. While the one bird broods, the other guards its mate and the hunting territory. As soon as a bird of the same species or another larger bird appears upon the scene, the watching bird utters a long penetrating cry and attacks the unwelcome guest; having chased him off, the skua again takes its seat near the brooding mate. If you retire some 50 meters the bird will quickly settle upon the nest again. The clamorousness and fearlessness of the bird make it easy to discover nearly every nest, even on a most extensive territory.
>
> If the eggs be removed from the nest, the skua will nevertheless as a rule lie down upon the nest for some few minutes. In a certain case I saw a bird lying more than half an hour upon the empty nest.
>
> *Young.*—The chicks, which soon after the hatching leave the nest, seem during the first days to be principally fed with insects. In the gullet of a newly hatched bird I found a crane-fly (*Tipula*), but they are even when quite young able to eat lemmings, which the parents hunt, eat, and afterwards disgorge before them. The young ones grow very quickly. It is a well-known fact that the young of this skua appear before the first molt in two-color varieties—a pale and a dark. The pale variety seems to occur somewhat more frequently than the dark.

Though this and the preceding species were both common in northwestern Greenland, the members of the Crocker Land Expedition failed to find the nest of either. To illustrate the peculiar behavior of this species near its nest, I quote from Mr. Ekblaw's notes of July 16, 1914, as follows:

> Though I failed to find them I felt confident that I had been very near either the eggs or the young of *Stercorarius longicaudus* to-day. Among the rocks just above Moraine Lake a pair of these birds flew uneasily about me and alighted from time to time near me as I searched at length for the nest that I suspected was on the plateau. The male boldly perched within 40 feet of me, and though the female was shyer she did not leave me far either. An ingenious deceit that the female attempted is worthy of note. After flying nervously near and about me she flew to a large bowlder and settled down snugly beside it, to all appearance as if she were returning to her nest. I hastened to the place exultantly, only to find, when the bird flushed, that she had deceived me. After another nervous flight about me she repeated the performance, and again I was deceived, even though I waited until I thought she would tire of her strategy, if deceit it were. When she tried a third time to delude me I waited to let her tire, but her patience outwore mine and I finally flushed her. In an hour's search of the moraine afterwards I failed to find any nest.

Plumages.—The only downy young that I have seen is plainly colored without any dark markings. It varies from "bister" or "buffy brown" above to "wood brown" below, being darkest on the back. Yarrell (1871) describes "a nestling in half-down" as "pale smoke-brown on the downy head and under parts with very dark brown feathers tipped with rufous on the back and wings."

Although the adults of the long-tailed jaeger are not known to have light and dark phases, there seem to be two quite distinct types of coloration in the juvenal plumages. In the dark phase the upper parts are dark "brownish black," or "clove brown"; the head, neck, and chest are mainly dusky, the latter mottled with "wood brown"; the feathers of the back and wing-coverts are edged with "cinnamon" or "wood brown," and the rump is spotted with the latter color; the lower parts are mainly buff, mottled and barred, chiefly on the sides and under tail-coverts, with dusky. In the light phase the upper parts are much the same as in the dark phase, but much lighter colored, and the pale "wood brown" edgings are broader and more prevalent; the head and neck are mainly "pinkish buff" and the crown is but little darker; the head is uniformly covered with linear streaks of pale dusky; the under parts are largely whitish, tinged with pale "pinkish buff," nearly immaculate on the breast and belly, but heavily barred on the sides and under tail-coverts with dusky. These descriptions are taken from young birds, collected early in August, in full, fresh, juvenal plumage. Other specimens taken late in September show similar well-marked color phases, but birds a year older do not seem to show them. This plumage is worn, with slight modifications, during the first year; the brown edgings fade out to white and gradually wear away; probably a partial molt occurs during the winter and spring. At the first postnuptial molt, the following summer, a complete change produces the second-year plumage. In this plumage the upper parts are much as in the adult, except that there is only a trace of the yellow on the sides of the head, often none at all; the two central tail feathers now project decidedly beyond their fellows, which was hardly noticeable in the previous plumage; but the under parts are more or less barred with dusky, particularly on the flanks and chest, and heavily so on the under tail-coverts. This plumage is worn for about a year or so until the second postnuptial molt, which is complete, beginning in June and lasting through September. At this molt the long central tail feathers and the dusky under tail-coverts are assumed; the young birds then assume the adult plumage when a little over 2 years old.

Adults have a partial prenuptial molt in the early spring and a complete postnuptial molt in August, September, and October. The seasonal changes in adults are not conspicuous, though freshly molted birds in the fall have the chin, throat, and neck clouded with light drab and the dark crown less pronounced than in the spring. The characters by which this and the foregoing species can be recognized are somewhat involved and confusing; so, rather than discuss them here, I would refer the student to Dr. L. Stejneger's (1885) excellent remarks on the subject.

Food.—In their summer homes on the tundra these jaegers live on a varied bill of fare. They are said to feed largely on lemmings, field mice (*Microtus*), and other small mammals. They catch flies, butterflies, and other insects and eat their larvæ. In the summer they rob bird's nests to devour the eggs and young, and sometimes they pursue and kill wounded birds for food. Probably a few fish are caught and many are stolen from gulls and terns. They also pick up considerable offal of various kinds, as well as small crustaceans and worms. During the latter part of the season they feed largely on crow-berries (*Empetrum nigrum*) and other berries. While migrating or during the winter they associate with the smaller gulls and terns, depending largely for food on what they can steal from these industrious birds or what they can pick up, in company with these common scavengers, in the way of garbage.

Behavior.—To watch the long-tailed jaeger in flight is one of the delights of the Arctic summer, for it is one of the swiftest and most graceful of birds on the wing; its light and slender form is propelled by its long, pointed wings with the speed of an arrow, its broad tail serving as an effective rudder, as it twists and turns in pursuit of its fellows or some luckless gull or tern, with its long central tail feathers streaming in the wind. Doctor Nelson (1887) says:

> They appear to be much more playful than the other jaegers, and parties of six or eight may be seen pursuing one another back and forth over the marsh. The long, slender tail feathers and extreme grace on the wing of these birds render them very much like the swallow-tailed kite.

Mr. Turner (1886) observes that it is "extremely swift on the wing, and when pursuing another bird thrashes the air with wing and tail, giving an undulatory motion to the body." It swims lightly and gracefully on the water, holding its long tail pointed upward; but I have never known it to dive below the surface.

Doctor Nelson (1887) describes the notes as follows:

> They have a shrill phĕū-phĕū-phĕū-phĕō̆, uttered while they are flying, and when the birds are quarreling or pursuing one another the ordinary note is often followed by a harsh qua. At other times they have a rattling kr-r-r-r, kr-r-r-r, kr-r-r-r, krī, krī-krī-krī, the latter syllables shrill and querulous and sometimes followed by the long drawn pheū-pheū-pheū in the same tone.

All writers refer to the predaceous habits of the jaegers. Their behavior toward other species is certainly not above criticism. On their breeding grounds they have the reputation of being nest robbers, according to the reports of the natives, eating the eggs and small young of any of the birds which are smaller or weaker than themselves. Such pilfering is done on the sly, however, for the jaeger is far from courageous and is often attacked and driven away from the nests of gulls, terns, curlew, sandpipers, and other shore birds.

Doctor Nelson (1887) "saw a jaeger swoop down at a duck paddling quietly on the surface of a pond, and the latter went flapping away in mortal terror, while the jaeger passed on, probably highly pleased at giving the duck such a fright." Mr. Turner (1886) says:

> Should one of their kind be shot and slightly wounded the others will gather around it, and if not frightened away will soon dispatch their comrade.

Mr. Hersey's notes on the long-tailed jaeger at St. Michael state:

> I have found this jaeger to be more peaceable and less given to chasing the gulls than the parasitic. I have seen as many as five or six of this species and a dozen or more short-billed gulls feeding in company on the refuse from the hotel, which had been put on a scow to be carried out into the bay and dumped; each bird paid no heed to his companions and there was no quarreling. The small shore birds and longspurs seem to regard him as an enemy, however, and follow him about over the tundra whenever one appears. Both this and the parasitic jaeger show caution when among a flock of glaucous gulls, and I have never seen them attempt to molest one of these large birds. At times they bother the little Sabine's gulls.

Mr. Frank C. Hennessey, who has sent me his notes on the birds of Winter Harbor, says, on the other hand, that "they tyrannize all others of their tribe, including the snowy owl, and make known their presence by successions of sharp but not discordant cries. These birds, considering their size, are quite able to fight for and defend themselves, particularly when any intruder may happen to encroach on the locality in which their nest is situated; in such a case they have been known to even attack the Arctic fox."

Mr. A. L. V. Manniche (1910) writes:

> Not rarely I observed falcons pursued by skuas (*Lestris longicauda*). At the end of August the young skuas will frequently be sitting around on stones, still cared for by their parents, which with extreme violence will guard their offspring against attack from falcons. The skuas exceed by far the gyrfalcons in ability of flight, and the falcons therefore always wish to escape the pursuit and retire to the rocks. Most frequently three or four skuas would join in an attack. The battle would usually be fought out immensely high up in the air.

Mr. Walter H. Rich has contributed the following notes on the behavior of jaegers on the fishing banks among the shearwaters:

> Both yagers and skuas bully the "hags," dropping on their backs as often as these latter are found enjoying a dainty bit. The yagers fight and quarrel much among themselves also. On several occasions the writer saw them clinch in the air to fall 20 or 30 feet, striking and clawing all the while. Only rarely do they annoy the skuas, and then somewhat carefully, usually in breezy weather, when they may the more easily escape consequences through their superior abilities in maneuvering; less often still do they trouble the large gulls, as the "black backs." Of the latter species I saw one in the brown plumage, when weaving his dignified flight through a cloud of "kittiwakes," turn suddenly to shoot upward and seize a long-tailed yager by the flank, bringing away a mouthful of feathers with a wicked side wrench of his head, causing the victim to squeal in angry indignation and put on full power ahead.

> It seemed to be sheer malevolence on the gull's part, for the yager was merely balancing before and above him in the gale, unmindful of his enemy's presence until the blow fell. Yet it may have been the payment of some ancient grudge.

The behavior of this and the foregoing species among the gulls and terns along on coasts is well known and has already been well described under the previous species. But the following passage from Audubon (1840) seems worth quoting:

> It generally passes through the air at a height of 50 or 60 yards, flying in an easy manner, ranging over the broad bays, on which gulls of various kinds are engaged in procuring their food. No sooner has it observed that one of them has secured a fish than it immediately flies toward it and gives chase. It is almost impossible for the gull to escape, for the warrior, with repeated jerkings of his firm pinions, sweeps toward it with the rapidity of a peregrine falcon pouncing on a duck. Each cut and turn of the gull only irritates him the more and whets his keen appetite until, by two or three sudden dashes, he forces it to disgorge the food it had so lately swallowed. This done, the poor gull may go in search of more; the lestris is now for a while contented and alights on the water to feed at leisure. But soon, perceiving a distant flock of gulls, he rises on wing and speeds toward them. Renewing his attacks, he now obtains an abundant supply and at length, when quite gorged, searches for a place on which to alight unseen by any other of his tribe more powerful than himself.

Fall.—During the months of August and September the jaegers. old and young, leave their northern breeding grounds and start on their southward migration, and the first arrivals often appear on the coasts of New England and California during the former month, showing that some individuals must start very early or must migrate very rapidly. Doctor Nelson (1887) says that "the long-tailed species is less frequently found at sea than the last, and is rarely found about the ice pack north of Bering Straits." Numerous records from the interior of the United States and Canada would seem to indicate that the main migration route is overland rather than coastwise.

Winter.—Prof. Wells W. Cooke (1915) makes the remarkable statement that "it seems probable that the long-tailed jaeger does not regularly winter anywhere in the Western Hemisphere. The winter home is in the Eastern Hemisphere, south to Gibraltar on the Atlantic side and to Japan on the Pacific." He evidently regards all the numerous fall records on both coasts and in the interior as accidental occurrences and either overlooks or disregards Audubon's (1840) statement that this species "often ranges" to the coasts of Florida and the Gulf of Mexico in winter; as well as Wayne's (1910) more recent records for South Carolina in December and Florida in February, where it was "observed in numbers."

DISTRIBUTION.

Breeding range.—Arctic coasts of both hemispheres. In North America from northwestern Alaska (Yukon Delta) along the coast at least as far east as Franklin Bay; on Ellesmere Land, Grinnell Land, and northern Greenland (on the west coast from Disco Bay north to 82° and on the east coast from Scoresby Sound north to 80°); probably on other islands in the Arctic Archipelago. South to northern Labrador (Cape Chidley), Southampton Island, and the west coast of Hudson Bay (probably as far south as York Factory). In the Eastern Hemisphere Iceland, Spitzbergen, Nova Zembla, the coast of northern Scandinavia, the Kola Peninsula, the Lower Petchora River, and the Arctic coast of Siberia south at least to the Gulf of Anadyr and St. Lawrence Island.

Winter range.—American winter records are very scarce. Has been seen at Caper's Island, South Carolina, on December 21, and off the St. Johns River, Florida, in February; has been taken once in California (Hyperion), January 26; taken and reported common in Argentina (Mar del Plata) in October; and taken in Chile (Valparaiso) in March and November. In the Eastern Hemisphere it winters south to Gibraltar and the Mediterranean, and on the Asiatic side to the northern Kurile Islands.

Spring migration.—Early dates of arrival: Florida, east coast, April 8; New Jersey, 80 miles off Barnegat, May 6; Ellesmere Land, Cape Sabine, May 23; northeastern Greenland, latitude 80°, May 28 to June 6. Dates of arrival in Alaska: St. Michael, May 12 to 15; Nulato, May 15; Kowak River, May 22; Point Barrow, May 30; Demarcation Point, May 24. Taken at Vancouver Island, May 11.

Fall migration.—Southward along both coasts and through the interior. Early dates of arrival: Massachusetts, Woods Hole, August 12; Connecticut, Wallingford, August 30; Alaska, Forrester Island, August 24; British Columbia, Chilliwack, August 23; California, Monterey Bay, August 2. Late dates of departure: Ellesmere Land Fort Conger, August 30; Massachusetts, Monomoy Island, September 29, and Woods Hole, October 13; Alaska, Point Barrow, August 21, and St. Michael, September 12; British Columbia, Okanagan Landing, September 18; California, September 19. Interior dates: Southampton Island, August 17; Manitoba, Lake Winnipeg, September and October 8; Missouri, Lake Como, October; Indiana, August 20, September 11 and 12, and November 30; Illinois, Cairo, November.

Egg dates.—Northern Alaska: Ten records, June 6 to July 12; five records, June 8 to 19. Northern Canada: Sixteen records, June 16 to July 12; eight records, June 27 to 30. Lapland: Nine records, June 2 to 20; four records, June 14 to 18.

Family LARIDAE, Gulls and Terns.

PAGOPHILA ALBA (Gunnerus).

IVORY GULL.

HABITS.

This beautiful, snow-white gull of the Arctic regions is decidedly boreal in summer and seldom wanders far south even in winter. It is circumpolar in its distribution and has been noted by nearly all Arctic explorers in both hemispheres. The names "ice-partridge" and "snow-bird," which are applied to this species, are both very appropriate, for the bird lives almost constantly in the vicinity of ice and snow, where its spotless plumage matches its surroundings. It is largely a bird of the open polar seas, frequenting the edges of the ice floes in company with the fulmars and other Arctic sea birds, and seldom resorting to the land except during the breeding season.

Nesting.—Prof. Robert Collett (1888) has given us a very good account of the nesting habits of the ivory gull, based on information furnished by Capt. Johannesen, who visited a breeding colony on the small island of Storöen, near Spitzbergen, in 1887. I quote from his excellent paper, as follows:

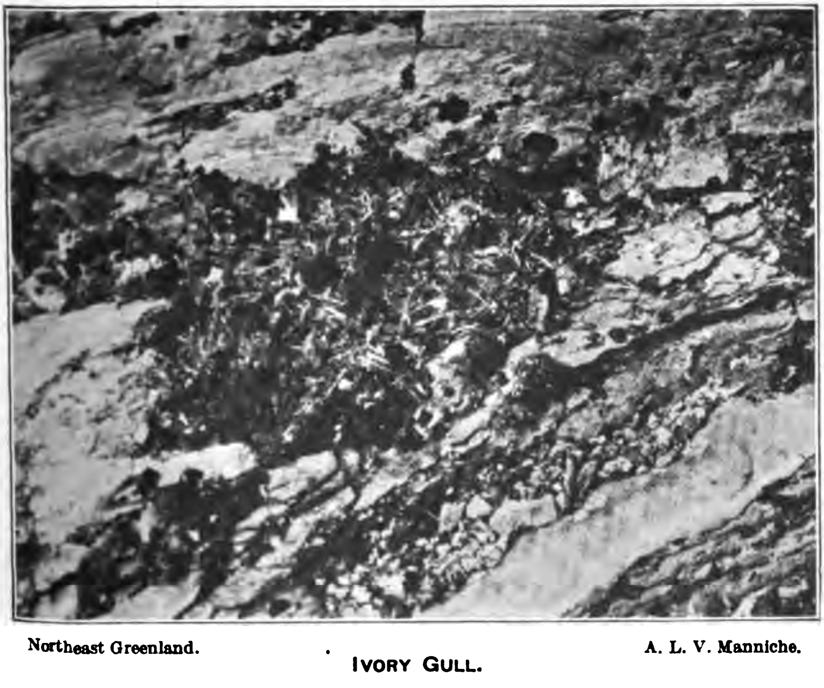
> On the 8th of August, when he visited the island, he found young birds in all stages, from newly hatched to fully fledged, together with a small number of eggs, which, however, were on the point of hatching, and in all probability not one would have been left a week later. Storöen is about 9 English miles in length and 6 in breadth; the greater part of its surface is covered by a glacier, which rises to a height of about 400 feet; the remaining portions consist of sand and gravel, with here and there small stones, likewise oases covered with moss; while in a few places the ground consisted only of rock.
>
> *L. eburneus* was breeding on the northeast side of the island, close to, or only a short way above, high-water mark, on low-lying ground like *L. canus*, *L. fuscus*, etc., and not in the cliffs. Capt. Johannesen estimated the number of nests at from 100 to 150; they were somewhat apart, at distances varying from 2 to 4 yards. There were one or two eggs or young, but never more in a nest. On being examined at Tromsö it was found that all the 19 eggs contained almost fully developed young chicks. Many of the nests contained young of various ages, whilst others were already empty. Several black-spotted young, capable of flight, were seen, likewise several young birds of the previous year's brood remained on the breeding ground. The nest is composed chiefly of green moss, which forms about nine-tenths of its mass. The rest consists of small splinters of driftwood, a few feathers, single stalks, and leaves of algae, with one or two particles of lichen. No trace of straw is to be found; a couple of pebbles may possibly have appertained to the underlayer of the nest. The mosses occur in pieces the size of a walnut, or less, and have evidently been plucked in a fresh state from a dry subsoil, either on rocks or gravelly places. The mosses are all sterile. Several of the splinters of driftwood were found of a length of about 100 millim. Under the microscope they all proved to be of conifers, probably larch, drifted from the Siberian rivers. Some were very old;

others, however, being still hard and possessing a fresh appearance. The feathers, of which only a few were found, are snowy white and have probably fallen from the brooding bird. Some portions of the algae were dry, crumpled leaves and stalks of seaweed. Only a few bits of a lichen were found, which appear to have got in accidentally.

A most interesting account of the home life of this species in Franz Josef Land is published by Mr. W. Eagle Clarke (1898), in which he quotes from the journal of Mr. William S. Bruce, of the Jackson-Harmsworth Expedition, as follows:

> August 7. To-day we landed at Cape Mary Harmsworth, and the first thing we noted was an immense number of ivory gulls, and from their demonstrations and shriekings it soon became evident that they were nesting. As we traveled across the low-lying spit we found this was so. Here there are 5 or 6 square miles or more of fairly level ground, more or less terraced, being evidently a series of raised beaches. This, if not the largest, is one of the largest areas of bare ground in Franz Josef Land. Beyond a few lichens and occasional patches of moss there is very little vegetation, only two flowering plants being found—a saxifrage and a grass, and these very sparingly, indeed. There is very little actual soil, and the surface is rough and rugged with large stones. Scattered all over it are numerous fresh-water ponds, the largest of them perhaps 200 yards across. The first signs of the ivory gulls' nests were patches of old moss every here and there, which at first we could not make out. As we advanced we saw more of these patches, and these seemed more compact. On approaching closer to these the birds made still more vehement demonstrations, swooping down upon us and giving vent to their feelings by uttering a perfectly deafening shriek close to our heads.
>
> Once in the midst of their nests—for these patches of moss were their nests—we had many hundreds of birds around us, first one swooping down to within a foot of our heads, and immediately after another. In some cases they actually touched us, and in one instance knocked the hat off a man's head. Most of the nests were empty, owing to the late date; but here and there was a single egg, and in two nests I found two eggs. Going on through this gullery we found that near certain nests, which were apparently empty, the birds made even more violent demonstrations than before, and in looking carefully about we descried a young ivory gull in its greyish-white downy plumage, and hardly visible against the stones, which were of a very similar color. Even the older ones, which were more whitish, were difficult to see among the stones. These young birds would sit crouched in between two or three large stones, and one might at first sight take them for stones also. On picking up a young bird the parents became quite distracted and threatened us more vehemently than ever. By-and-by we passed out of this gullery, but further along we could see others, each with many hundreds of these birds, and we advanced toward them. The gullery we left gradually became quiet; but the birds in the one which we were approaching were beginning to demonstrate in the same way as those at the last. The cries became louder and louder, and in a few minutes we were again in the midst of the deafening shrieks of a host of terrified yet defiant birds. Again they swooped down upon us, and it seemed quite likely that at any moment they might dash into our faces. So we passed on from gullery to gullery among many thousand of these birds. It was a magnificent sight; the sun was shining brightly in a blue sky, the air was clear, and these handsome birds in their pure white plumage added brilliancy to the scene. Each nest

Northeast Greenland. A. L. V. Manniche.



Northeast Greenland. A. L. V. Manniche.

IVORY GULL.

FOR DESCRIPTION SEE PAGE 329.

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is, as I have said, composed of a pile of moss, in shape a truncated cone, and may be from 6 to 9 inches in height and from 18 inches to 2 feet in diameter. There is no hollow on the top of this more or less level pile, upon which the egg is deposited or the young bird sits. I noticed many dead young birds, some quite recently deceased, for they were still warm, while others had been dead for some time. In nearly every case their crania had been indented.

Doctor Malmgren, of the Swedish expedition to Spitzbergen in 1861, found a colony of ivory gulls breeding in entirely different situations. Baird, Brewer, and Ridgway (1884) quote from his notes, as follows:

> On the 7th of July, 1861, I found on the north shore of Murchison Bay, latitude 80° N., a number of ivory gulls established on the side of a steep limestone precipice some hundred feet high in company with the *Rissa tridactyla* and *Larus glaucus*. The last named occupied the higher zones of the precipice. The *Larus eburneus*, on the other hand, occupied the niches and clefts lower down, at a height of from 50 to 100 feet. I could plainly see that the hen birds were sitting on their nests, but these were inaccessible. Circumstances did not permit before the 30th of July my making the attempt, with the help of a long rope and some necessary assistance, to get at the eggs. With the assistance of three men I succeeded in reaching two of the lowest in situation, and each contained one egg. The nest was artless and without connection and consisted of a shallow depression 8 or 9 inches broad in a loose clay or mold on a sublayer of limestone. Inside the nest was carefully lined with dry plants, moss, grasses, and the like, and a few feathers. The eggs were much incubated and already contained down-clad young. Both of the hen birds were shot upon their nests and are now in the National Museum. The male birds were at first observable, but disappeared when we began the work of reaching their nests.

Eggs.—The ivory gull lays a set of one or two eggs. Two of the eggs taken by Captain Johannesen are in our National Museum, and Major Bendire (1888) has described them as follows:

> Their ground color is buffish olive; in one egg, somewhat paler, perhaps more of an olive-drab tint. The surface markings, more or less irregularly distributed over the entire egg, vary from clove-brown to bistre. The underlying or shell markings vary from slate to lilac-gray in tint and predominate in the larger specimen. In the smaller and darker one, both styles of markings are about equally distributed. The two kinds of spots vary considerably in size and shape.

Professor Collett (1888) describes nine of the eggs, as follows:

> The ground color of five specimens is almost entirely alike—viz, a light grayish-brown tint, with faint admixture of yellowish green, such as often appears on the eggs of *L. canus;* which, however, have often a deeper brown or green hue. In structure and gloss all nine eggs greatly resemble those of *L. canus;* but the granulations under the microscope are a little coarser, more uneven, and in larger numbers; on the other hand, the granulations are perceptibly finer than in *L. fuscus*. The eggs are easily distinguished from those of *Rissa tridactyla* by their greater gloss, and the small excrescences do not lie quite so crowded, and are a little more flattened than they usually are in the last-mentioned species.

The measurements of 32 eggs in various collections average 60.5 by 43.6 millimeters; the eggs showing the four extremes measure 69.3 by 41.5, 62.6 by 44.6, 57 by 43. and 60.5 by 40 millimeters.

Plumages.—Prof. Collett (1888) describes the downy young as "white all over; the down white to the root"; and says that "even in this first stage the young in down may be distinguished from the young of other species by the strong and hooked claws, especially on the hind toe, the somewhat marginated web on the toes, and the forward nostrils. The downy covering is particularly close; *L. eburneus* in this respect is more closely related to the other species of *Larus* than to *Rissa*, the hairlike tips being shorter." A downy young bird in Doctor Bishop's collection, collected on King Charles Island on August 3, 1901, is covered with long, soft down, evenly colored above and below, "pallid mouse gray" shading into "pearl gray" at the base of the down. This is an older bird, however, as the first feathers are appearing on the scapulars.

Mr. Howard Saunders, in his edition of Yarrell (1871) says:

> The nearly fledged young are described by Richardson[1] as having ash-gray backs; but with regard to the subsequent stages of plumage there is an absence of satisfactory details, and the editor can only place the following facts before his readers: In the autumn of 1880 Mr. Leigh Smith brought back from Franz-Josef Land a bird which was supposed to be the survivor of several young taken from the nest, and which was presented to the zoological gardens. Its prevailing tone was gray, owing, perhaps, to the saturation of the plumage with grease and dirt acquired on board the steam yacht, where the bird is said to have frequented the stokehole; but after constant washing since its arrival at the gardens the bird still remained of a smoke gray, nearly as dark as a fulmar petrel on the upper parts, and especially so on the tail coverts, the feathers of the back and wing coverts having slightly darker shafts, and the head bearing not merely a mask but a short hood of a darker gray than the neck and the underparts. The tail was reduced by abrasion to a mere stump. Such was the description given by the editor when the bird was supposed to be from three to four months old,[2] and its correctness can be corroborated by other observers. It was naturally expected that at the next moult the bird would pass into the well-known spotted plumage, but no spots made their appearance, and this example at once assumed the pure white plumage which it now (April, 1884) displays. This omission of the spotted stage may, perhaps, be owing to captivity in a comparatively warm climate; the editor is unable to account for it.

The ordinary immature or first-winter plumage is white, heavily mottled with dusky or dark grayish spots on the sides of the head and throat, concentrating into almost solid color in the loral region; scattering spots of the same slate-gray are on the hind neck and upper back. The scapulars have subterminal dusky spots, as do also many of the lesser and nearly all of the greater wing coverts and tertials. The primaries, secondaries, and rectrices are broadly tipped with dusky, narrowly edged with white. As to how long this plumage is worn or at what age the adult, pure white plumage is acquired, I am in doubt. Selby (1833) says:

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[1] Journal of a boat-voyage, p. 281.

[2] Zoologist, 1880, p. 484.

> As the bird advances in age the brown spots and bars gradually decrease at each molt, and it is supposed to be perfectly matured in two years and a half.

I very much doubt if it requires any such time as two years to reach maturity, and I have never seen a bird with any spots on it at all, except a few on the edge of the wing, which I thought was over a year old. Probably the dusky tips wear away somewhat during the winter or are partially replaced by white feathers at an incomplete prenuptial molt, and at the first postnuptial molt the pure white adult plumage is assumed; but, unfortunately, I have not been able to study sufficient material to determine this with certainty or to understand fully the seasonal molts of adults. Adults apparently have but one complete annual molt in July and August. I have seen an adult which had not begun to molt its much-worn plumage on July 3, and another, in fresh plumage, which had completed the molt on August 30. These are in the Dwight collection, which also contains two specimens, taken July 6 and 13, molting both wings and tails, and another, taken on May 30, in which the wings are molting, beginning with the inner primaries.

Food.—The feeding habits of the ivory gull are hardly becoming a bird of such pure and spotless plumage. It is a greedy and voracious feeder and is none too particular about the quality of its food or how it obtains it. When some of these birds have been feeding on the carcass of a whale they present a sorry spectacle, for in their eagerness to satisfy their gluttonous appetite they crowd themselves into the entrails of the animal and their beautiful white plumage becomes smeared with blood. They are particularly fond of the blubber and flesh of whales, walruses, and seals, even when somewhat putrid, and, when busily engaged in such a feast they are tame and unsuspicious. Nothing in the way of animal food comes amiss to them and they even frequent the holes in the ice used by seals for the purpose of feeding on the excrement of these animals. Pieces of meat, blood, or offal from slain animals scattered on the ice or snow will always attract them. Any refuse thrown from the galley of a ship is readily picked up. Mr. Kumlien (1879) says that he once saw one try to swallow the wing of an eider, which the cook threw overboard. They also feed to a large extent on lemmings and other small rodents. On their breeding grounds, in the Polynia Islands, Captain McClintock (1856) found the bleached bones of lemmings scattered about their nests, "also fresh pellets, consisting of their bones and hair."

Behavior.—The flight of the ivory gull is said to be light and graceful. Yarrell (1871) says "that its note is shrill and not unlike that of the Arctic tern, and its flight is more like that of a tern than of an ordinary gull." Nuttall (1834) writes: "Its only note consists of a loud and disagreeable scream." Selby (1833) says: "Its voice is strong and harsh." Mr. A. L. V. Manniche (1910) says: "This pretty bird, with its short but sonorous note, would make a wonderfully animating impression in these silent and desolate surroundings."

Winter.—The migration amounts merely to a withdrawal from its breeding grounds and such northern portions of its summer range as are rendered uninhabitable by the closing in of ice and snow. The species is merely forced southward by the advance of winter conditions and frequents the more or less open edge of the ice pack all winter. Mr. Clarke (1898) makes this statement:

> Dr. Neale records that in the autumn of 1881 the ivory gulls departed from Cape Flora (Franz Josef Land) at the end of October, and arrived there the following spring on the 20th of April. Dr. Nansen observed them for the first time in 1896 as early as the 12th of March, at his winter quarters on Frederick Jackson Island.

On the Labrador coast it seems to occur in the late fall only. Mr. Kumlien (1879) noted it as "very common" in Cumberland Sound "just before it froze up, for a few days only." Doctor Townsend (1907) writes:

> Dr. Mumford, Mr. Frank Lewis, and others at Battle Harbor told us of shooting "ice patridges," which came with the ice and seals in November or December. They stay for about two weeks or a month and then depart, not to be seen again for a year. At times they are very abundant and even fly about the houses. These birds are shot for food, and are often obtained in the following manner: About a gallon of seals' blood is poured on the ice near the rocks, and as the birds hover about they are easily shot. Some of the birds in their eagerness to obtain the blood dash themselves with such force against the ice as to kill themselves.

A recent occurrence of the ivory gull in Portland Harbor, Maine, is recorded by Mr. Arthur H. Norton (1918); he and Mr. Walter H. Rich observed it at short range on January 5, 1918. He says:

> The snowy whiteness of its plumage was always noticeably different from any other gull in the harbor, which contained at the time an abundance of *Larus argentatus* in all plumages, *Larus kumlieni*, and *Larus leucopterus*. Its habits and flight also differed distinctly; it was much more restless, now alighting on the ice, either to remain at rest for a few minutes, or to feed at the water's edge, and then away to search the edge of the ice field or to feed near some of the docks. It seemed to pay little or no attention to the other gulls or their feeding. On the ice it ran rapidly, suggesting the action of a large plover.

Its restlessness and independent action suggested to me the action of *Larus atricilla*, as it appears in the company of *Larus argentatus*. Its dashing flight seemed more like that of a jaeger than that of a gull. The wing was used at full extent with very little flexure at humero-radial and carpal joints, and was broad and wedge shaped in comparison with the narrower wing of *Larus argenatus*. It was seen for the last time January 7 by Mr. Rich, though daily watch has been kept to the present time (Feb. 22, 1918). During the period that the bird was seen the mercury was hardly rising above 0° F., and the harbor and bay was a solid field of ice except as broken by the ever busy tugs laboring to keep an open channel.

DISTRIBUTION.

Breeding range.—High northern latitudes, probably circumpolar. Known breeding places: Prince Patrick Island, Melville Island (Winter Harbor), northern Baffin Land (Port Bowen), and northern Greenland (Kane Basin and Kennedy Channel, and on the northeastern coast from latitude 74° to 81°); also said to have bred at Darnley Bay, east of Franklin Bay, on the Arctic coast. In the Eastern Hemisphere, at Storöen near Spitzbergen and Franz Josef Land.

Winter range.—Probably the open circumpolar seas as far north as unfrozen water occurs. Said to occur in some numbers in winter in southern Greenland and along the Labrador coast. In Europe it occasionally winters about the coasts of Great Britain and Ireland and northern France. Many winter records are of single birds, probably stragglers.

Spring migration.—Early dates of arrival: Melville Island, Winter Harbor, May 24; Ellesmere Land, Peterman Fiord, May 28; Greenland, Etah, June 1; Prince Patrick Island, June 12. Late dates of departure: Quebec, Godbout, March 7; Labrador, Sandwich Bay, June 12; Alaska, Point Barrow, May 22 to June 2.

Fall migration.—Fall and winter wanderings are erratic. Dates of arrival: Cumberland Gulf, October 24 and November 5; Anticosti Island, October; Quebec, Godbout, December 9; New Brunswick, St. John, November; Maine, Portland, January 4 and 5; Massachusetts, Monomoy Island, December 1; Long Island, Sayville, January 5; Bering Strait, November 9; Commander Islands, December 2. Dates of departure: Ellesmere Land, Lincoln Bay, September 1; Wellington Channel, September 15; Boothia Felix, September 21; Alaska, Point Barrow, September 25 to October 10.

Casual records.—Has occurred twice in British Columbia (Dease Lake, Cassiar, September, 1899, and Penticton, Okanagan Lake, October, 1897).

Rare or accidental in Ontario (Toronto, December 25, 1887).

RISSA TRIDACTYLA TRIDACTYLA (Linnaeus).

KITTIWAKE.

HABITS.

The hardy kittiwake has been well named, on the New England coast, the "frost gull" or the "winter gull," for its arrival seems to indicate the coming of hard frosts and the beginning of real winter. It seems to bring with it the first cold breath of ice and snow from the rugged Arctic coasts where it makes its summer home. This species is always associated in my mind with icebergs and the great Greenland ice packs, which drift southward with the Arctic current, and in its summer home, with the dark, frowning cliffs of the frozen north, which tower for hundreds of feet above the stormy ice-bound seas until lost to sight in shrouds of mist and fog, where the "frost gulls" find a safe retreat in which to rear their hardy offspring.

Spring.—According to Hagerup (1891) the kittiwakes arrive in Greenland early in April:

> From their arrival till the middle of May they keep together in one or more large flocks, and are then very timid and noisy. This is, perhaps, because the fjord is to a great extent covered with ice, so that their nesting ground lies 8 to 10 miles from open water. On clear days in April a flock of some 2,000 may be seen rising to a great height, say 3,000 and to 4,000 feet, sometimes going out of sight, so that one can only hear their screeching as they rapidly wheel about. They are then wont to make an excursion inland, above the ice, toward their breeding place. On returning they descend somewhat more scattered; but at once, on reaching the water, they gather close together. These exercises they often go through many times a day. In May they assemble in smaller flocks and are less shy. About 2,000 lay their eggs on the front of a perpendicular cliff situated at the head of the fjord. The lowest nests may easily be reached from a boat; the highest are about 150 feet above the sea. The eggs are laid chiefly during the first 10 days of June, and the young fly from their nests about the middle of August. (The earliest date on which I have seen a young bird is the 7th of August.) After that they generally go about in small flocks or singly and keep comparatively silent. On a few occasions only, on August afternoons, I have seen large flocks of 500 to 1,000 individuals rise to a great height and fly toward the ocean.

Courtship.—Mr. Edmund Selous (1905) says, in referring to the courtship of the kittiwake, that the inside of the mouth is of "a fine rich red, or orange red color," and that "both sexes open their bills widely and crane about, with their heads turned toward each other, whilst at the same time uttering their shrieking, clamorous cry. The motion, however, is often continued after the cry has ceased; and this we might expect if the birds took any pleasure in the brilliant gleam of color which each presents to and, as it were, flashes about in front of the other."

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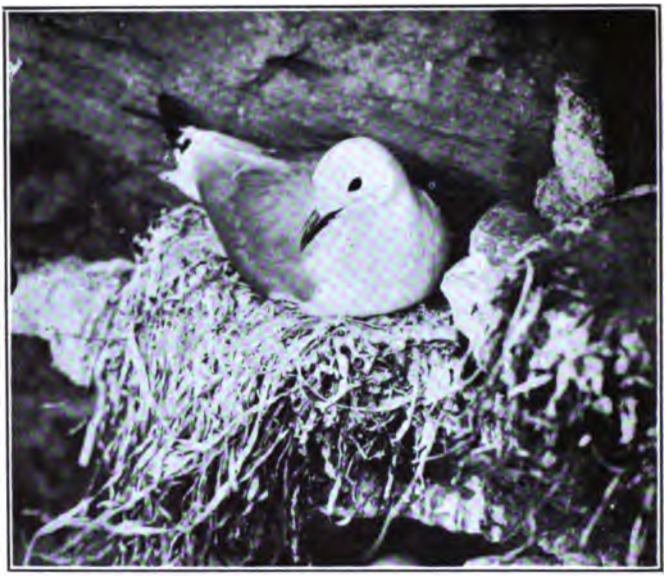
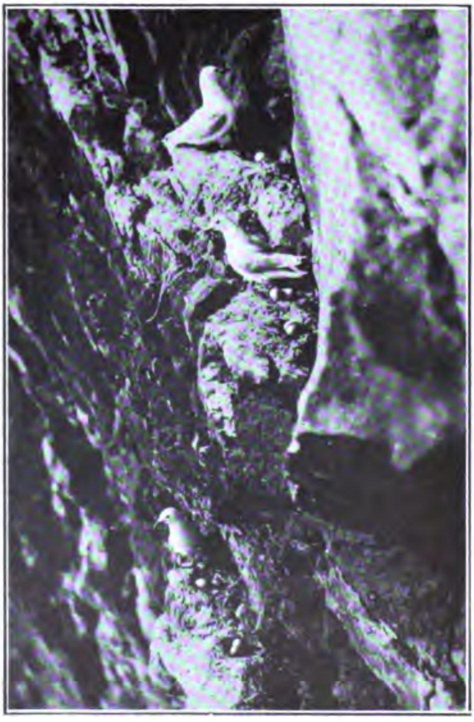


Bird Rock, Quebec. H. K. Job.



Bird Rock, Quebec. A. C. Bent.

KITTIWAKE.

FOR DESCRIPTION SEE PAGE 329.

Mr. W. Elmer Ekblaw, in his Greenland notes, says:

> About June 10 the kittiwake begins mating. The rivalry for mates and nests is keen, and the struggles over the nests are bitter and prolonged. I watched two birds fight for a nest for over an hour. When one alighted upon the nest he turned at once with open bill and angry scream to meet the rival which he expected to attack him at once. Usually the other claimant for the nest was quick in his attempt to eject the first. With bills locked like the jaws of fighting bull terriers, they wrestled with each other, shaking and tugging and pulling fiercely until they fell off the ledge and fluttered to the ice still in death grip. Once on the ice they soon ceased their combat, and separated, both angrily screaming. The contest was many times repeated.

Nesting.—The kittiwake is decidedly an oceanic gull, being seldom seen inland, except as a wanderer on migrations, and breeding on the rocky cliffs and crags of our Arctic coasts exposed to all the fury of ocean storms in which it seems to delight. On the Greenland coast most of the large breeding colonies are on the high cliffs near the heads of deep fjords, but farther south the preference seems to be for lofty rocky islands.

My first intimate study of the nesting habits of the Atlantic kittiwake was made on the famous Bird Rocks, in the Gulf of St. Lawrence, in 1904, one of the southernmost outposts of its breeding range. We landed here in a small boat, late in the evening of June 23, under rather exciting circumstances. As the great cliffs towered above us in the moonlight we saw a lantern coming down the ladder to show us where to land and we ran in among the breakers. There was a crash which brought us to our feet as we struck an unseen rock; but the next wave carried us over it and landed us among the rocks and flying spray. We were overboard in an instant, struggling in the surf up to our waists, for the boat was rapidly filling, as wave after wave broke over us. A few moments of rapid work served to unload our baggage and attach a stout line to the boat, the signal was passed aloft and the powerful steam winch above landed her high and dry. After exchanging hearty greetings with our genial host, Captain Bourque, we enjoyed the novel experience of being hoisted up in a crate to the top of the cliff, over 100 feet high. It was certainly a new and interesting sensation to feel ourselves slowly rising in the darkness up the face of these somber cliffs, with the surf thundering on the rocks below us and with a cloud of screaming seabirds hovering about us, barely discernible in the moonlight, like a swarm of ghostly bats whose slumber had been disturbed and who were protesting at our rude intrusion.

On the following day the wind was blowing a gale and clouds of sea birds were drifting about the rock in a bewildering maze, 10,000 of them in all. There were great white gannets sailing on long powerful wings, tipped with black; clouds of snowy kittiwakes hovering in the air; hundreds of swift-winged murres and razor-billed auks darting out from the cliffs; and quaint little parties of curious puffins perched on the rocks. There was a constant babel of voices, the mingled cries of the varied throngs; deep, guttural croaks and hoarse grunts from the gannets; a variety of soft purring notes from the murres; and sharp, piercing cries from the active kittiwakes distinctly pronouncing the three syllables for which they are named, as if beseeching us to "keep away" from their precious nests.

For a more intimate study of their nesting habits we were lowered down the face of the cliff in a crate, dangling at the end of a long rope and whirling helplessly about in space, but within a few feet of the confiding, gentle birds on their nests. They were so accustomed to the intimacy of man that it was an easy matter to study and photograph the dainty creatures at short range. Their nests were scattered all over the perpendicular face of the cliff, on every available little shelf. I was surprised to see how small and narrow a ledge could support a nest in safety. The nests were firmly and well built of seaweeds, grasses, and mosses, and were securely plastered on to the rock; apparently they were made of wet seaweed which adhered firmly to the rock as it dried; evidently the nests had been used for successive seasons, fresh material being added each year. They were deeply cupped and well built up on the outer sides, so as to form safe cradles for the young. Incubation was far advanced at this date (June 24), and many of the eggs had hatched. The nests must, indeed, be well built to hold the weight of two lusty young and the brooding parent in such precarious situations. Mr. Ora W. Knight (1908) gives the dimensions of a nest found on Baccalieu Island, Newfoundland. "Its diameter at base was 1 foot, and at top 8 inches; interior diameter, 6 inches; and depth, 2 inches."

Eggs.—The kittiwake is said to lay as many as four or five eggs, but I believe that two is the usual number; that three eggs are rarely laid; and that larger numbers are very unusual. I am quite sure that more than 90 per cent of the nests that I have seen have held only two eggs. Often only a single egg is hatched. The eggs vary in shape from somewhat pointed ovate to short ovate, rarely elongate ovate; the shell is thin and smooth, but without much lustre. The ground color varies from "pinkish buff" or "olive buff" to "cartridge buff," "pale olive buff," or bluish white. The spots are irregular in arrangement, size, and shape; most eggs have underlying spots or blotches of "light Quaker drab" or "light mouse gray"; these are either overlaid or mixed with darker spots, blotches, or scrawls of "clay color," "snuff brown," "tawny olive," "Vandyke brown," or "sepia" of various shades. The measurements of 41 eggs in various collections average 56.1 by 40.8 milli-

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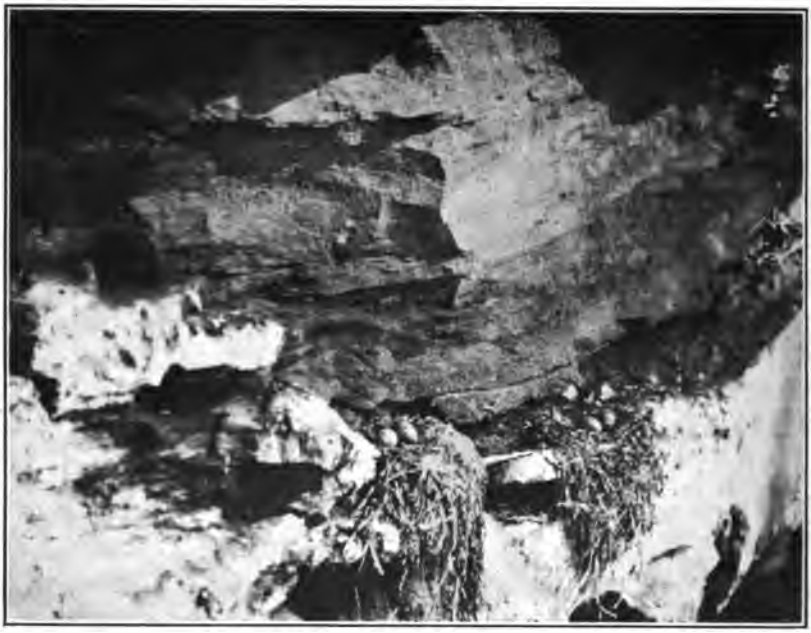
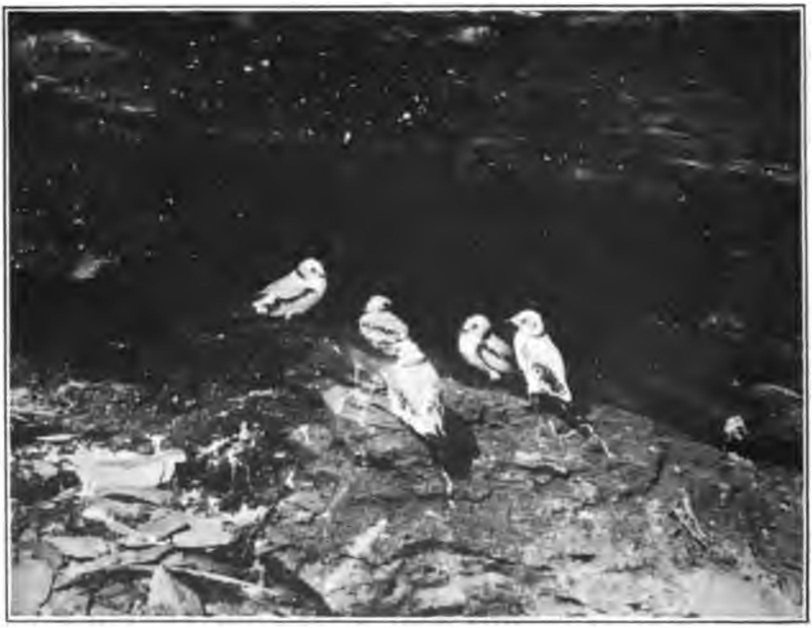


Bird Rock, Quebec. A. C. Bent.



Bird Rock, Quebec. A. C. Bent.

KITTIWAKE.

FOR DESCRIPTION SEE PAGE 330

meters; the eggs showing the four extremes measure 62.5 by 42.5, 58 by 43.5, 53 by 39 and 55 by 37.5 millimeters.

Young.—The period of incubation is said to be 26 days. Probably both sexes incubate, as both parents are usually together at the nest and both are devoted to the young. The young remain in the nest, where they are fed by their parents, until they are fully fledged. The narrow confines of the usual nest, on its small shelf of rock, permit no wandering habits, as common among other gulls. Any attempt to stray from the nest would usually result in a disastrous fall from a dizzy height to dangerous rocks or surf below; so the young birds must of necessity stay in the nest until able to fly. Many such fatal accidents probably occur, which serve to keep in check the increase of the species, which is otherwise secure from molestation on its nesting grounds.

On North Bird Rock, where many of the nests are on the lower ledges, I noticed on July 24, 1915, that many of the nearly fledged young had been able to crawl or jump out of the nests and were wandering about over the flat rocks below the cliffs, though they were not able to fly. Many of the older young were already on the wing at this date and a few were still in the nests.

Plumages.—The newly hatched young is covered with long, soft, glossy down, which is white and spotless, but tinged basally with yellowish gray and buffy on the back and thighs, and tipped with dusky, giving it a grizzly appearance, quite unlike other young gulls. The young bird grows rapidly and soon begins to assume the first winter plumage, which appears first on the scapulars, then on the wings, back, and neck. There is no strictly juvenal plumage in this species. In the first winter plumage the bill is black; there is a blackish patch on the hind neck; the lesser wing-coverts and sometimes the greater wing-coverts and scapulars are largely black; the tail has a broad black band at the tip; the dusky spots on the head, before and behind the eye, are darker than in adults. A partial molt occurs early in the spring, usually in February and March, but sometimes as early as December, in which most of the dusky feathers in the head are replaced by white or lighter colored feathers and the black lesser wing-coverts disappear. At the first postnuptial molt in August young birds become indistinguishable from adults when one year old, a complete molt producing the adult winter plumage. A partial prenuptial molt, involving the head, neck, and body feathers, produces the adult nuptial plumage with the pure white head and yellow bill. Adults have a complete molt in the summer, producing the well-known winter plumage.

Food.—A flock of feeding kittiwakes is an animated and a pretty sight. During the latter part of the summer they assemble in enormous numbers in the numerous bays and "tickles" of the Labrador coast, and congregate about the fishing vessels to pick up the scraps that are thrown overboard. A school of small fry, swimming near the surface, soon attracts an interested throng of these little gulls which hover over them and scream excitedly as they gently swoop down with elevated wings to pick the small fish from the surface without wetting a feather. Although small fishes procured in this way constitute the principal food of the kittiwake, it also eats crustaceans, aquatic larvæ, and other marine animals which it gleans from the water. It feeds to some extent along the beaches and on the bare sand flats at low tide, where it finds various small mollusks, crustaceans, and other marine invertebrates. Often large flocks are seen feeding in the flats. It is less of a scavenger than the larger gulls and less given to frequenting the inner harbors. It is said to drink salt water exclusively, being seldom seen inland. Mr. Brewster (1883) reports a captive kittiwake that refused fresh water and drank salt water eagerly.

Behavior.—The flight of the kittiwake is buoyant, graceful, and easy. Audubon (1840) describes its movements, in his usual graphic style, as follows:

> Bearing up against the heaviest gale, it passes from one trough of the sea to another as if anxious to rest for an instant under the lee of the billows; yet as these are seen to rear their curling crests, the gull is already several feet above them and preparing to plunge into the next hollow. While in our harbor, and during fine weather, they seemed to play with their companions of other species. Now with a spiral curve they descend toward the water, support themselves by beats of their wings, decline their heads, and pick up a young herring or some bit of garbage, when away they fly, chased perhaps by several others anxious to rob them of the prize. Noon has arrived. High above the masthead of our largest man-of-war the kittiwakes float gracefully in wide circles until all, as if fatigued, sail downward again with common accord toward the transparent deep, and, alighting close to each other, seem to ride safely at anchor. There they now occupy themselves in cleaning and arranging their beautiful plumage.

It flies more swiftly than the larger gulls and with more rapid wing beats. It can be readily recognized by the flight, even at a long distance, by one who is familiar with it. Dr. Charles W. Townsend writes to me:

> Although the flight of the kittiwake is characteristically graceful, rapid, and swallow like, with quick wing strokes, I have seen them get up from the surface of the water just in time to clear the bow of the advancing steamer and fly off with slow and heavy wing beats, as if loath to leave a good fishing ground. In the adult the black wing tips are short and cut squarely across, as if the wings were dipped in black. In the immature plumage it most closely resembles the young Bonaparte's gull, but the black nuchal crescent and the black wing coverts are conspicuous, and there is more black on the primaries, in which the color pattern is also different.

The ordinary cry of the kittiwake suggests its name, which it seems to pronounce quite distinctly. This is the soft and mellow note most often heard about its breeding grounds, but when much excited or alarmed, it indulges in loud, shrill, piercing screams, as it darts down upon the intruder. When hovering in large flocks over a school of fish or other tempting feast it becomes very noisy, uttering loud, harsh cries, somewhat resembling the notes of the gull-billed tern. Doctor Townsend adds the following notes:

> Besides the cry, which recalls its name *Kit-ti-wake*, I have noted down the syllables *Ka-ake;* sharp and piercing *Ki, Ki, Ki;* rapidly repeated and harsh rattling *Kaa, Kaa, Kae, Kae,* and *Kaak Kaak.*

The gentle kittiwake is a highly gregarious and sociable species. Among the various sea birds, with which it is intimately associated on its breeding grounds, it is a harmless and a friendly neighbor. It does not seem to molest the eggs or young of the other species at all and it has no enemies among them. At other seasons it is often persecuted by the jaegers, the relentless pursuers of all the smaller gulls and terns, the highway robbers of the northern seas. The worst enemy of the kittiwake is man. In winter, when these gulls are abundant on the New England coast, they are shot in large numbers. They are tame and unsuspicious, gathering, like terns, in large flocks over a fallen companion, making it easy for the gunner to kill as many as he chooses. They may easily be attracted about the fisherman's boat by throwing overboard cod livers or other refuse, where they are easily shot and may often be caught on a baited hook. Their bodies are used for food or for bait and their plumage is, or was, sold for millinery purposes; but often they are killed in purely wanton sport. Macgillivray (1852) says of the way these birds have been killed on the British coast:

> Parties are formed on our eastern coast for the sole purpose of shooting them; and I have seen a person station himself on the top of the kittiwake cliff of the Isle of May, and shoot incessantly for several hours, without so much as afterwards picking up a single individual of the many killed and maimed birds with which the smooth water was strewn beneath.

Fall.—The fall migration starts early; that is, the birds move away from their breeding grounds early and begin to work down the coast in August and September. Dr. Charles W. Townsend (1907) saw about 5,000 kittiwakes at the mouth of Hamilton Inlet, Labrador, on July 18, 1906. He describes their behavior as follows:

> At Hamilton Inlet thousands of kittiwakes covered the water, and as we steamed on they rose in bodies of 500 or more and whirled about like gusts of snow driven by the wind, their pure white plumage lit up by the rays of the setting sun. Silent for the most part, they occasionally emitted cries of *kae kae*, or *ka-ake*, and at times one could imagine the syllables of *kittiwake.* On our return trip we ran into a flock of nearly the same size near Cape Harrison. The appearance of a snowstorm here was more perfect, for there was a thick fog bank, on the edge of which the kittiwakes played. The sun shining on the birds before the fog shut them out was very striking. They were occa-

> sionally plunging for capelins, at times disappearing entirely under water with a splash. One could often be seen flying with a fish hanging by one end from its bill. A jaeger suddenly appeared on the scene, and the twisting and turning of pursuer and pursued was interesting to see. The kittiwake finally dropped his prey, and the jaeger settled on the water to pick it up.

On my way south along the Labrador coast on August 21, 1912, I saw large numbers of old and young kittiwakes near Makkovik and Ragged Islands, far south of their breeding grounds. Mr. Lucien M. Turner says of their habits on the Labrador coast:

> Scores and hundreds of the kittiwake gull were observed on the Labrador coast in the early part of July, 1882. They were most numerous in the Arctic current bearing icebergs, on which these birds at times assembled in thousands as the mass of ice towered at times over 200 feet high and presented an area of over half a mile square on the top of it. Here the birds sat compactly, slowly moving to the southward; they probably congregated during these times after having gorged themselves with capelins and lance fishes to allow the process of digestion to be completed. A single rifle shot reverberating against the wall of ice or a ball projected in the midst of these birds was sufficient to startle the entire community into flight, and upon which they would lazily circle round and round the vessel or sway back and forth across her wake, always at a provoking distance, until one would be dropped while on wing with a rifle ball. The living birds wheeled over their dead companion in angry curiosity as they clamored their rattling cry.

Winter.—The kittiwake does not become common on the Massachusetts coast until about the middle of October, after which it is common off our coasts all winter, where it is known as the "winter gull," "frost gull," or "pinny owl." Dr. Charles W. Townsend (1905) says of its winter habits:

> The kittiwake is an offshore gull, one that is to be found especially about fishing vessels in winter, gleaning the waves for the refuse which is always to be found in the neighborhood of these boats. In my notes of a trip to Nova Scotia from Boston, in December, 1883, I have entered that they were very abundant everywhere off the coast. Off Rockport in winter, kittiwakes begin to be common 2 or 3 miles from land, and are generally abundant on the fishing grounds, 8 or 10 miles out. They may, however, be frequently seen from the shore, especially if the day be stormy and the shore an open one. They often visit the little harbor of Rockport with its wealth of fish gurry. They also fly occasionally over the beaches, and under these circumstances I have had no difficulty in shooting them for specimens, as, unlike the herring gull, they do not hesitate to fly within gunshot. I have never seen them in the tidal estuaries.

Mr. Walter H. Rich has sent me the following notes on the behavior of the kittiwake or "winter bird," as it is called, on Georges Banks:

> As might be guessed from the name, it is during the coldest weather that this bird is most abundant, and at this season, so the writer was informed, not infrequently they became so tame as to perch in rows upon the main booms of the vessels on frosty mornings, awaiting their breakfasts.

The first arrivals (five birds) appeared on the morning of October 12, 1913. Every day following their arrival showed increasing numbers until in a fortnight there were always "hundreds," and at times "thousands" would make but a moderate estimate of their flocks. My records for November 16 says, "winter birds in millions"—perhaps an exaggeration, yet so it seemed. Scarcely a daylight hour after their arrival but was filled with their chattering squeal; scarcely a moment but saw them wheeling about the steamers, appearing just before sun up and standing by to give any needed assistance as long as the sun held above the western rim of the ocean.

The signal for hauling the net brought great activity among the flocks banked up on either side of the steamer's path in 2½-mile-long lines of white birds roosting upon the water. There were literally thousands of gulls that rose and drifted along over the swells, just keeping pace with the steamer's slow progress. Other gulls there were, both brown plumaged and full plumaged—ring-bill, herring gull, black-backed, and a few of the large white or pearly gulls, of species undetermined where they wheeled in a safe offing. But all these were at a disadvantage, both numerically and otherwise, with the kittiwakes, who stole from them and beat them to every piece of liver and waste thrown overside. If the prize sinks the big gull has lost it; not so the little "winter bird," who dives swiftly and gracefully from the wing and brings it up. This is the only gull which the writer has ever seen to dive. Naturally their success makes them unpopular with the losers, who pursue and harry the kittiwake, but to little effect, since the small gull is too active to suffer much in these attempts at reprisal.

In fair weather during midday the gulls of all species soar far aloft to wheel in wide circles and drift in the sunshine of the upper air. The "winter bird" indulges in this also, but to a somewhat lesser extent than do the gulls of other species. The greater part of the kittiwake flocks prefer to bank up along the steamer's course, so as to be at hand at the haul, utilizing the interval to preen their feathers and bathe and dip like sparows in a puddle. In fact, it was a considerable time before I could be sure that the kittiwake joined in these lofty aerial maneuvers; yet they surely did, sweeping on motionless wings in great spirals at a height where the eye could hardly follow them or distinguish them, but never failing to drop with all swiftness when warned by the whistle that the feast was about to be spread for them. What an enormous amount of food must be needed to support all this great sea-bird population—the hags and petrels in the summer months, the gulls in the colder weather, the full round of the year.

DISTRIBUTION.

Breeding range.—Northern parts of the Northern Hemisphere; in North America east to Greenland and the Labrador coast. South to the Gulf of St. Lawrence (Newfoundland, Bird Rock, Bonaventure Island, and Anticosti) and probably parts of Hudson Bay. The western limit of its range, where the subspecies *pollicaris* takes its place, is unknown, but it has been stated to occur west to Franklin Bay. North to Prince Albert Land (near Princess Royal Islands); the south shore of North Somerset; north of Wellington Channel (latitude 77°), and northern Greenland (Thank God Harbor on the northwestern coast, and between latitude 80° and 81° on the northeastern coast). In the Old World breeds from Iceland, Great Britain (Shetland and Orkney Islands, Hebrides, coast of Ireland and England, except southern parts); Spitzbergen, probably Franz Josef Land, Nova Zembla and coast of western Siberia (said by Koren to range east to Chaun Bay, northern Siberia. South to northwestern France.

Breeding grounds protected in the Canadian reservations on Bird Rock, Bonaventure Island, and Percé Rock.

Winter range.—Offshore from Gulf of St. Lawrence (Prince Edward Island), Nova Scotia (Halifax), New Brunswick (Grand Manan), and coast of Maine; occasionally on the Great Lakes; south to New Jersey and the Bermudas, and even farther south (latitude 25° 57′ N., east of Miami). In Europe winters from the coasts of Great Britain south to the Mediterranean and Caspian Seas, the Canary Islands, and Azores.

Spring migration.—Return from ocean wandering to its breeding grounds. Early dates of arrival: Prince Edward Island, March 15 (average March 26); Quebec, Godbout, March 25 (average April 6); Greenland, Ivigtuk, March 26; Dover Strait, May 20; and Cape York, June 10. Late dates of departure: Bermuda, April 4; New York, Orleans County, April 10; Connecticut, New Haven, April 13.

Fall migration.—Offshore and southward. Early dates of arrival: Massachusetts, October 2 (average November 6); Long Island, October 13; Pennsylvania, Erie, October 17. Late dates of departure: Northeastern Greenland, latitude 75° 20′, August 1; Ellesmere Land, Lincoln Bay, September 1; Wellington Channel, September 2; Frobischer Bay, September 2; Cumberland Gulf, September 19; Newfoundland, October 17.

Casual records.—Wanders occasionally to various points in the interior; to the Great Lakes frequently, as far west as Michigan (Neebish Island, fall 1893–94) and Wisconsin (Racine, March 17, 1884); up the Mackenzie Valley (Fort Resolution, May 23, 1860): west in the interior to Wyoming (Douglas, November 18, 1898).

Egg dates.—Great Britain: Thirty-one records, April 6 to June 27; sixteen records, June 4 to 12. Newfoundland: Ten records, May 30 to July 1; five records, June 14 to 20. Gulf of St. Lawrence: Ten records, June 10 to 26; five records, June 13 to 25.

RISSA TRIDACTYLA POLLICARIS Ridgway.

PACIFIC KITTIWAKE.

HABITS.

The Pacific form of the well-known kittiwake differs from its eastern relative in having a larger hind toe and more extensive black tips on the primaries, but its habits are practically the same and its life history is similar. The two subspecies together occupy a wide range throughout the northern part of the northern hemisphere, giving the species a circumpolar distribution.

Spring.—The spring migration is early, reaching Bering Island, in the Commander group, according to Stejneger (1885), about the 1st of April. In Bering Sea the migration is delayed until the breaking up of the ice. Nelson (1887) says:

> At St. Michaels each year they arrive from the 10th to the 18th of May, and were first seen searching for food in the narrow water channels in the tide cracks along shore. As the open spaces appeared they congregated there until in early June, when the ice broke up and moved offshore. At this time the kittiwakes sought the rugged cliffs along the shore of the mainland or the precipitous islands dotting Bering Sea and the adjoining Arctic.

Courtship.—Very little seems to be known about the courtship or mating performances of this bird, but Mr. H. W. Elliott (1875) says that "the male treads the female on the nest, and nowhere else, making a loud shrill, screaming sound during the ceremony."

Nesting.—We saw plenty of kittiwakes near the eastern end of the Aleutian Islands, where they were probably breeding in the vicinity of Akutan Island. West of Unalaska we saw very few birds and no signs of breeding colonies. Doctor Stejneger (1885) found them breeding in "astonishing numbers" at certain places in the Commander Islands, at the western end of the chain, where they choose "steep walls, rising perpendicularly out of the deep sea, and especially high pinnacles standing lonely amidst the foaming breakers, provided they are fitted out with shelves and projections upon which to place the nests." Dr. W. H. Dall (1873) gives us the following good account of a breeding colony in the Shumagin Islands, south of the Alaska Peninsula:

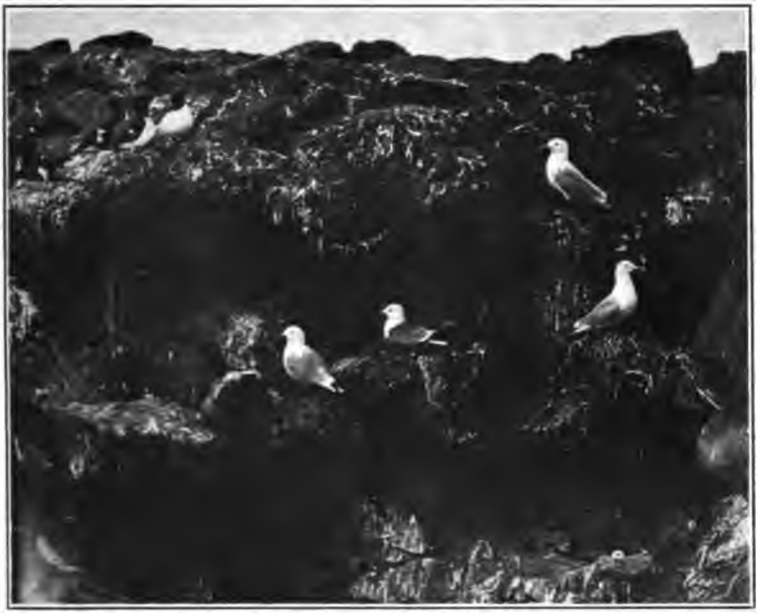
> On entering Coal Harbor, Unga, we were at once struck with the peculiar white line which wound around the precipitous cliffs of Round Island, and was seen to be caused by the presence of birds; and as soon as an opportunity was afforded I took a boat and went to the locality to examine it. The nests, in their position, were unlike anything I had ever seen before. At first it appeared as if they were fastened to the perpendicular face of the rock, but on a close examination it appeared that two parallel strata of the metamorphic sandstone of the cliffs, being harder than the rest, had weathered out, standing out from the face of the cliff from 1 to 4 inches, more or less irregularly. The nests were built where these broken ledges afforded a partial support, though extending over more than half their width. The lines of nests exactly followed the winding projections of these ledges, everywhere giving a very singular appearance to the cliff, especially when the white birds were sitting on them. The nests were built with dry grass, agglutinated together and to the rock in some unexplained manner; perhaps by a mucus secreted by the bird for the purpose. The nests had a very shallow depression at the top in which lay two eggs. The whole establishment had an intolerable odor of guano, and the nests were very filthy. The birds hardly moved at our approach; only those within a few yards leaving their posts. I reached up and took down two nests, one containing two young birds, and the other empty. Wind coming up,

> we were obliged to pull away, and the bird, which came back, lighted on the rock where her nest and young had been with evident astonishment at the mysterious disappearance. After flying about a little she again settled on the spot, and, suddenly making up her mind that foul play on the part of some other bird had taken place, she commenced a furious assault on her nearest neighbor. As we pulled away the little fellows began to be effected by the motion of the boat, and with the most ludicrous expression of nausea, imitating as closely as a bird could do the motions and expression of a seasick person, they very soon deposited their dinner on the edge of the nest. It was composed of small fishes or minnows, too much disorganized to be identified. Eggs, in a moderately fresh condition, were obtained about the same time, but most of them were far advanced toward hatching.

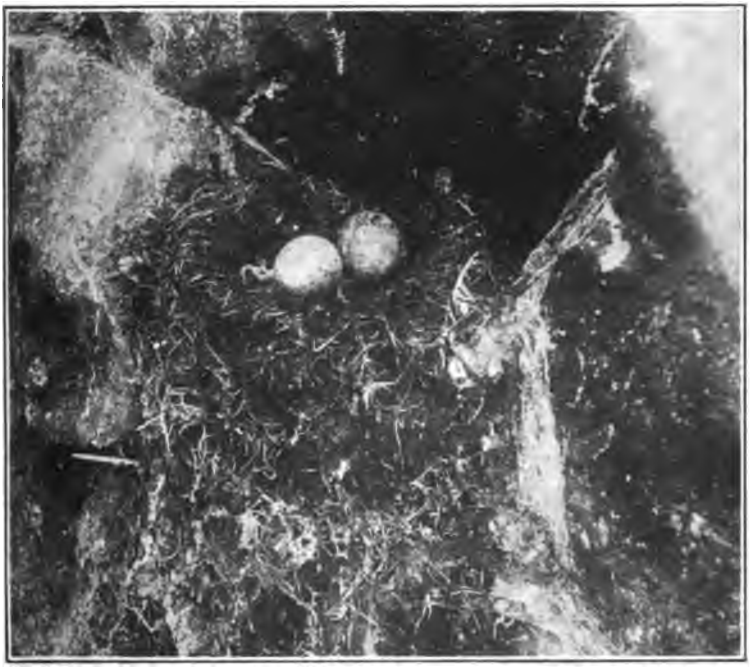
In Bering Sea we found this to be one of the commonest gulls and found it breeding on all of the islands where it could find high, rocky cliffs. On Walrus Island, where there are no high cliffs, we had an unusually good opportunity to examine the nests. Among the hosts of sea birds which made their summer home on this wonderful island a few little parties, of from four to six pairs each, of Pacific kittiwakes found a scanty foothold on the vertical faces of the low, rocky cliffs. Here their nests were skillfully placed on the narrow ledges or on little protuberances which seemed hardly wide enough to hold them, and often they were within a few feet of nesting California murres or red-faced cormorants, with which the island was overcrowded. The nests were well made of soft green grass and bits of sod securely plastered onto the rocks and probably were repaired and used again year after year. They were well rounded, deeply cupped on top, and lined with fine dry grass. Most of the nests, on July 7, contained two eggs, some only one, but none of them held young. The incubating birds and their mates standing near their nests were very gentle and tame. We had no difficulty in getting near enough to photograph them.

Eggs.—The eggs of the Pacific kittiwakes are practically indistinguishable from those of the Atlantic kittiwake, though they will average a trifle larger and a trifle more pointed. The ground color seems to run more to the lighter shades, from "tilleul buff" or "olive buff" to "cartridge buff" or "pale olive buff." Many sets show very pale shades of "glaucous green" or even greenish or bluish white. The markings are about the same as in the Atlantic bird, but average lighter with a larger proportion of the drab or gray spots. The measurements of 40 eggs in the United States National Museum and the writer's collections average 58.4 by 41.3 millimeters, the eggs showing the four extreme measure **63** by **43.5**, **55.5** by 41.5 and 58.5 by **37.5** millimeters.

Young.—The young remain in the nests and are fed by their parents until they are able to fly. Both old and young birds spend much of their time on their breeding grounds and frequent their old



Walrus Island, Alaska. A. C. Bent.



Walrus Island, Alaska. A. C. Bent.

PACIFIC KITTIWAKE.

FOR DESCRIPTION SEE PAGE 330

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nests until ready to migrate in September. The description of the downy young and the sequences of molts and plumages, already given for the Atlantic kittiwake, will do equally well for the Pacific subspecies. I can find no essential points of difference.

Food.—Nelson (1887) says of their feeding habits:

> From the end of August they frequent the inner bays and mouths of small streams, and are often seen in large parties feeding upon the myriads of stickle backs which are found along the coast at this season. They pursue their prey in the same graceful manner as the terns, by hovering over the water and plunging down head foremost. In the bay at St. Michaels they were frequently seen following a school of white whales, evidently to secure such fragments of fish or other food as the whales dropped in the water. It was curious to note how well the birds timed the whale and anticipated their appearance as the latter came up to blow.

Along the beach at Nome we saw kittiwakes almost constantly where they seemed to be picking up bits of garbage. Mr. A. W. Anthony (1906) saw them in winter at Puget Sound, associated with other gulls about the garbage heaps.

Behavior.—Dr. E. W. Nelson (1883) pays the following tribute to the flight powers of this kittiwake:

> During our cruising in the summer of 1881 I had repeated occasions to notice the graceful motions and powers of flight possessed by this handsome gull. Its buoyancy during the worst gales we met was fully equal to that possessed by the Rodger's fulmar, with which it frequently associated at these times. These birds were continually gliding back and forth in graceful curves, now passing directly into the face of the gale, then darting off to one side on a long circuit, always moving steadily, with only an occasional stroke of the wings for long periods if there was a strong wind.

Mr. William Palmer (1890) also shows his admiration of it in the following words:

> Viewed from the cliffs the flight of these birds is remarkably graceful, and especially so when they have been disturbed from a midday siesta. I thus disturbed several dozen one day and carefully watched them as they passed and repassed the spot where I sat on the edge of the cliff. They were all within 20 yards and continually paraded parallel with the cliff, all the while intently watching me. They would pass by for some 30 to 40 yards, then turn and fly an equal distance on the other side before again making a turn. Usually the whole distance was accomplished by sailing, and often the turns and several lengths were traveled in the same way. Thus, selecting an individual and keeping my eyes on him I often counted from two to three trips without a flap of the wing. One individual thus noted made the trip seven times without once changing his wings from their rigid outstretched position. The length of his parade was fully 50 yards and he sailed in an almost straight line, and rarely varied his level, being about as high above the sea as I was on the cliff. Not a movement of the air was perceptible to my senses. He was often so close that as he passed I could distinctly see the movement of his eye as he slightly turned his head to view me. Several times the fly lines of two birds would cross at about the same level, but rarely would one flap to gain impetus enough to get rapidly out of the way. It was more often

accomplished by a quiver of the wings on the part of one of the two, a slight rise as the other passed beneath, and then a similar descent, and the continuation of the journey without any distinct flapping whatever. They thus sailed in plain view as long as I remained on the rocks, probably 30 minutes.

Winter.—These hardy birds of Arctic seas seem quite at home among the drifting ice and snowstorms, and it is not until their summer feeding grounds become permanently closed with winter ice, in October, that they are forced southward to spend the winter months in the Aleutian Islands, along the Alaska coast, and south to Puget Sound, or even California. Here they associate freely with the other common gulls on the coast or spend their time offshore. They are so much more pelagic in their habits than other gulls that they seem much less abundant than they really are.

DISTRIBUTION.

Breeding range.—Coasts and islands of the North Pacific, Bering Sea, and the adjacent Arctic Ocean. East to Cape Lisburne and other suitable parts of the western Alaskan coast. South to Seldovia, Alaska, the Shumagin, Aleutian, Commander, and Kurile Islands. West along the coast of Kamchatka and northeastern Siberia to the Koliutschin Islands. Occurs in summer, but has not been found breeding on the coast of southern Alaska (Yakutat and Sitka) at Point Barrow and on the Siberian coast from Koliutschin Islands to Chaun Bay.

Breeding grounds protected in the following national reservations in Alaska: Aleutian Islands (as Kiska, Near Islands, Unga, Unimak Pass), Pribilofs, St. George Island.

Winter range.—From southeastern Alaska (Sitka) and perhaps from the Aleutians, south along the coast of British Columbia, Washington, Oregon, and California to northern Lower California (San Geronimo Island). On the Asiatic side south to the Kurile Islands and Japan (Yezo and Tokyo).

Spring migration.—A return from ocean wandering to its breeding grounds. Early dates of arrival: Commander Islands, Bering Island, April 1; Pribilof Islands, St. Paul, April 20; Alaska, St. Michael, May 6, and Point Barrow, June 2. Late dates of departure: Lower California, San Geronimo Island, March 17; California, Point Pinos, April 25; Washington, Port Townsend, May 19; British Columbia, May 24.

Fall migration.—Mainly eastward and southward off the coasts, beginning in July and reaching British Columbia in September. Average date of arrival at Point Pinos is November 14, earliest November 5. Late dates of departure: Alaska, Point Barrow, August 31, and St. Michael about October 15; Pribilof Islands, St. Paul, October 12; Siberia, Koliutschin Island, September 22.

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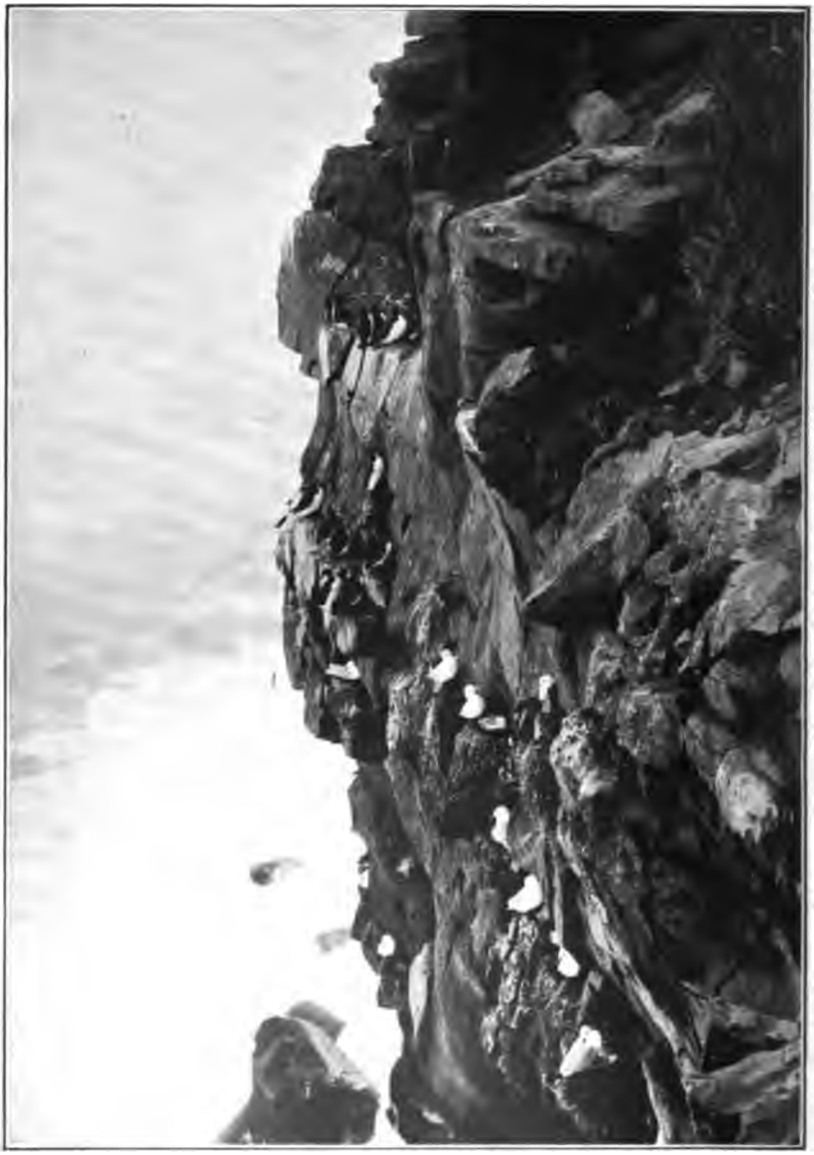

St. George Island, Alaska. C. H. Townsend.

RED-LEGGED KITTIWAKE.

FOR DESCRIPTION SEE PAGE 330.

Egg dates.—Pribilof Islands: Thirteen records, June 10 to July 7; seven records, June 25 to July 3. Northern Bering Sea: Nine records, June 10 to July 20; five records, June 20 to July 6.

RISSA BREVIROSTRIS (Bruch).

RED-LEGGED KITTIWAKE.

HABITS.

This is one of the species which I expected to find breeding abundantly among the Aleutian Islands, but I was disappointed to find that it was far from common about any of the islands that were visited. As we passed Akutan Island on the way to Unalaska I saw a large number of kittiwakes hovering about the rocky cliffs at a distance. I supposed that they were of this species, which is recorded as breeding on this island, but I was unable to stop and did not go near enough to identify them. I saw several about the Pribilof Islands, but only one specimen was taken. I did not find it on Walrus Island, where it is said to breed.

Nesting.—Mr. Henry W. Elliott (1880), to whom we are indebted for practically all that we know about the habits of the red-legged kittiwake, says that it arrives on the fur-seal islands, for the purpose of breeding, about the 9th of May and of its nesting habits he writes:

> It is much more prudent and cautious than the auks and the murres, for its nests are always placed on nearly inaccessible shelves and points of mural walls, so that seldom can one be reached unless a person is lowered down to it by a rope passed over the cliff. Nest building is commenced early in May, and completed, generally, not much before the 1st of July. It uses dry grass and moss cemented with mud, which it gathers at the fresh-water pools and ponds scattered over the islands. The nest is solidly and neatly put up; the parents work together in its construction most diligenty and amiably. Two eggs are the usual number, although occasionally three will be found in the nest. If these eggs are removed, the female will renew them like the "arrie" in the course of another week or 10 days.

Dr. L. Stejneger (1885) found the red-legged kittiwake breeding abundantly in the Commander Islands, and says:

> Like its black-legged cousin, it only selects steep and inaccessible rocks, and in none of its habits at the breeding place could I detect any marked difference. They also arrive at the islands about the same time, hatching their young simultaneously with the other species. The two species usually keep apart from each other. In the great rookery at Kikij Mys only one solitary red-legged bird was seen among the thousands and thousands of black feet, while a still greater colony at Gavaruschkaja Buchta consisted of red legs exclusively. On Copper Island, however, I found the two species breeding together on the same rocky wall—the black feet always higher up than the present species. The two kinds were easily distinguished when sitting on the nests, *brevirostris* having the gray of the mantle of a perceptibly darker shade than *pollicaris*.

Eggs.—The set usually consists of two eggs, rarely three, and often only one. The eggs are usually about ovate in shape, and in a general way resemble those of the common kittiwake, though they average lighter in color and are somewhat less heavily spotted. The ground color is bluish white, buffy white, creamy white, or even pure white. The markings consist of spots, blotches, or scrawls scattered irregularly over the egg or occasionally concentrated in a mass at the larger end or in a ring around it.

These markings are in various shades of drab, lavender, or lilac, overlaid with various shades of brown, mostly the lighter shades, but sometimes as dark as "bister" or "sepia." The measurements of 43 eggs, in various collections, average 55.8 by 40.9 millimeters; the eggs showing the four extremes measure **66.5** by **45** and **50** by **37** millimeters.

Young.—Mr. Elliott (1880) says:

> Both parents assist in the labor of incubation, which lasts a trifle longer than the usual time—from 24 to 26 days. The chick comes out with a pure white downy coat, a pale whitish-gray bill and feet, and rests helplessly in the nest until its feathers grow. During this period it is a comical-looking object. The natives capture them now and then to make pets of, always having a number every year scattered through the village, usually tied by one leg to a stake at the doors of their houses, where they become very tame; and it is not until fall, when cold weather sets in, that they become restless and willingly leave their captivity for the freedom of the air.

Plumages.—The downy young are not distinguishable from those of the Pacific kittiwake, being covered with white down without spots. So far as I have been able to learn from the available material the molts and plumages are similar to those of the common species. There is no juvenal plumage, the young bird going directly from the downy stage into the first winter plumage; in this plumage the young bird has a well-marked, dark, cervical collar, considerable dusky about the eyes, and a mantle variegated with grayish-white tips; but it has no black on the wing coverts, secondaries, or tail, as in the common kittiwake. These dark markings are usually wholly or partially lost during the first spring, but they are sometimes retained through the summer by failure to molt in the spring or by a partial renewal of feathers in sympathy with the first winter plumage. At the first postnuptial molt (in August) the adult winter plumage is assumed.

Adults have a complete postnuptial molt in August and apparently a partial prenuptial molt early in the spring. Winter adults have the cervix and the auriculars washed with plumbeous. In the adult nuptial plumage this is one of the most beautiful birds in Bering Sea, where we learned to recognize it by the short, yellow bill, bright red feet, dark mantle, and wings.

Behavior.—I can not find any data on the food of the red-legged kittiwake, but probably it does not vary materially from that of closely related species. Mr. William Palmer (1899) writes, concerning his impression of this species on the Pribilof Islands:

> To my mind this is the most beautiful species on the islands. Always graceful, whether on the cliffs or flying, its beautiful form and delicate snow-white plumage, with its vermilion feet, adds much to the avifaunal wonders of these islands. Unlike its cousin, which carries its feet extended when flying, this species nearly always buries them in the feathers of its under body, as if fearful of showing their beauty except when absolutely necessary. When fog envelops these islands, both the land and sea, the sea birds away from home find their way by flying along the edges of the bluffs, where the stored heat in the rocks dissipates the rapidly drifting fog. The wily aleut, knowing these characteristics, ensconces himself behind a rock in a suitable location and with a large dip net intercepts the birds on their way along the bluffs. Thus many a meal is obtained, and, unfortunately, our pretty red-legged kittiwake too often falls a victim.

Winter.—When the young birds are fully fledged and able to fly, both old and young birds desert their breeding places on the rocky cliffs, but do not migrate far away. They are resident throughout the year in the vicinity of the Pribilof and Aleutian Islands, and probably spend most of their time at sea during the winter months.

DISTRIBUTION.

Breeding range.—Islands of Bering Sea (the Pribilof, Near, and Commander Islands) are the only places where this species has been found breeding. It is supposed also to nest at various places in the Aleutians from Akutan Island westward.

Breeding grounds protected in the following national reservations in Alaska: Aleutian Islands, as Near Islands, Round Island, Unimak Pass, and Pribilof Islands.

Winter range.—Unknown. Probably the open sea not far from its breeding grounds. It has been stated not to winter on the Near and Commander Islands. Elliott says it occurs about the Pribilofs at all seasons.

Spring migration.—Apparently comes to the breeding grounds about May 9.

Fall migration.—Birds leave the Pribilofs as soon as the young can fly, usually early in October, latest November 11. Has been seen near Unalaska Island, October 5.

Casual records.—Taken at Forty Mile, Yukon Territory, October 15, 1889; St. Michael, Alaska, September 18, 1876; Kamchatka (specimen, but no date); and Wrangel Island (specimen, but no date).

Egg dates.—Pribilof Islands: Three records, July 1, 3, and 10. Kamchatka: Two records, June 12 and 22.

LARUS HYPERBOREUS Gunnerus.

GLAUCOUS GULL.

HABITS.

The name burgomaster is a fitting name for this chief magistrate of the feathered tribes of the Arctic seas, where it reigns supreme over all the lesser water fowl, levying its toll of food from their eggs and defenseless young. Well they know its strength and dread its power, as it sails majestically aloft over the somber, rocky cliffs of the Greenland coast, where, with myriads of sea fowl, it makes its summer home; and useless is it for them to resist the onslaught of its heavy beak when it swoops down to rob them of their callow young. Only the great skua, the fighting airship of the north, dares to give it battle and to drive the tyrant burgomaster from its chosen crag. Its only rival in size and power among the gulls is the great black-backed gull, and where these two meet on the Labrador coast they treat each other with dignified respect.

Spring.—The glaucous gull is more oceanic in its habits than other large gulls. Though it resorts somewhat to inland lakes and rivers during migrations and in winter, it seems to prefer the cold, bleak, and rugged coasts of northern Labrador, Greenland, and the Arctic islands, whither it resorts in the spring as early as the rigors of the Arctic winter will allow. What few birds winter in southern Hudson Bay and the region of the Great Lakes, migrate across Ungava and through Hudson Straits to the Atlantic coast; but the main migration route is northward along the seacoast following the open leads in the ice with the first migration of the eiders. Kumlien (1879) says:

> This gull is the first bird to arrive (at Cumberland Sound) in the spring. In 1878 they made their appearance in the Kingwah Fjord by the 20th of April. It was still about 70 miles to the floe edge and open water; still, they seemed to fare well on the young seals.

At Ivigtut, Greenland, according to Hagerup (1891), "some, chiefly young birds, remain over winter. An old bird, in complete summer dress, was shot on the 20th of March." In Alaska, also, this species is the earliest migrant to arrive. Turner (1886) observes that they arrive at St. Michael by the middle of April, "sailing high in the air, almost out of sight. Their note, being the first intimation of their presence, is always gladly welcomed as a sign that the ice, farther south, is breaking up." Nelson (1887) says:

> They wander restlessly along the coast until the ponds open on the marshes near the sea, and then, about the last half of May, they are found straying singly or in pairs about the marshy ponds, where they seek their summer homes. Here they are among the noisiest of the wild fowl.

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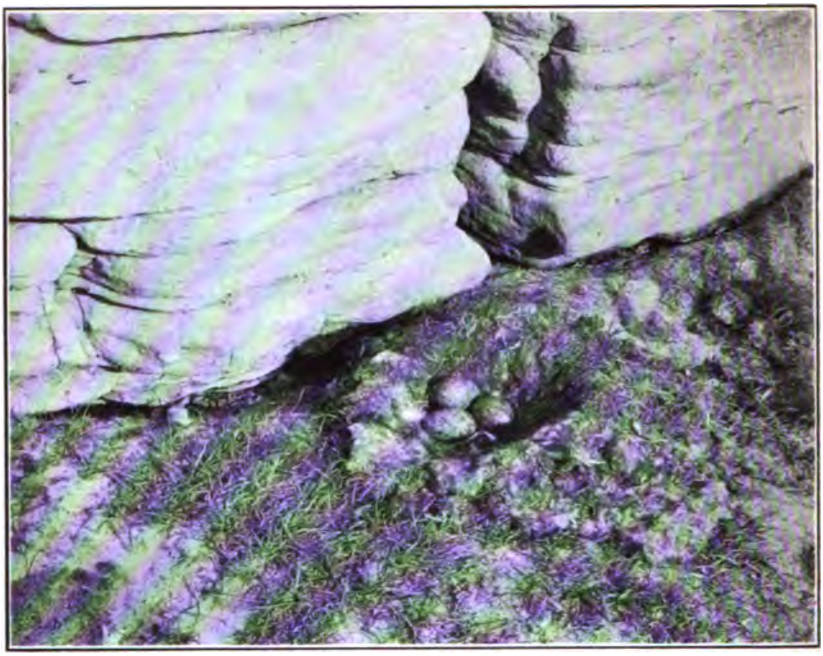
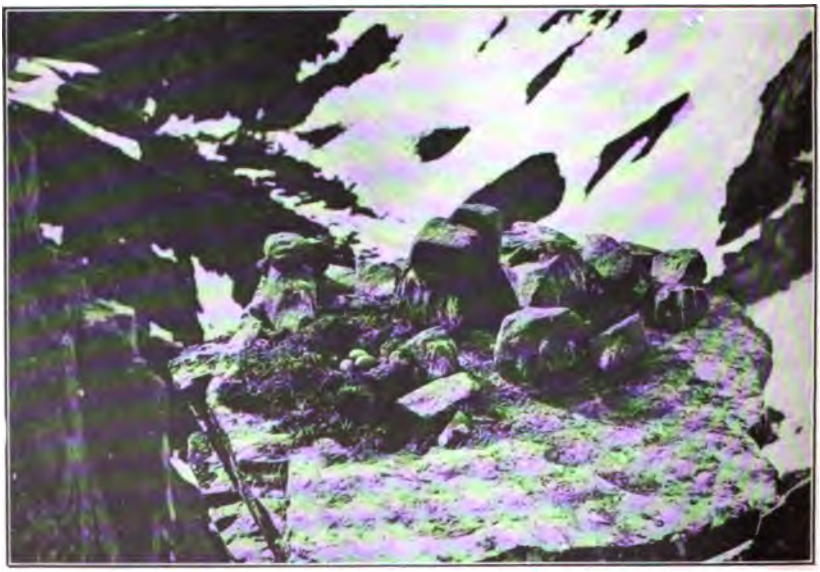


Borup Glenn, Greenland. D. B. MacMillan.



Sutherland Island, Greenland. D. B. MacMillan.

GLAUCOUS GULL.

FOR DESCRIPTION SEE PAGE 330

Grinnell (1900) noted their arrival in Kotzebue Sound May 11, 1899, when he "discovered 10 sitting close together out in the middle of the river ice." Winter was still unbroken at this date, and there was no open water in the vicinity "so far as he knew."

Nesting.—The southernmost breeding grounds of this species are in Newfoundland. Here in the summer of 1912 I saw them at several places, where they were probably nesting on the high and inaccessible rocky cliffs of the west coast. Other observers have also reported them from this region. Mr. J. R. Whitaker, of Grand Lake, told me that he had taken the eggs of this species on an island in Sandy Lake. While investigating a breeding colony of great black-backed gulls on an island in Sandy Lake, on June 23, 1912, I saw a pair of glaucous gulls flying overhead. The young of all the gulls had hatched at that date and were hidden among the rocks and underbrush, so I did not succeed in identifying any young of the glaucous gull, but I have no reason to doubt that the pair had nested there, perhaps on one of the small rocky islets by themselves. Mr. Edward Arnold (1912) reports that "several pairs had their nests built out on large bowlders in the center of ponds, but as the water was very cold and over our heads in depth we could not examine them."

On the Labrador coast in 1912 I found the glaucous gull common all along the coast from the Straits of Belle Isle northward. I saw a large breeding colony on the lofty cliffs of the Kigla-pait range between Nain and Okak. The nests were quite inaccessible on the narrow ledges of precipitous cliffs facing the sea. On August 2 we visited a breeding colony of 30 or 40 pairs of glaucous gulls on a rocky islet near Nain. It was a precipitous crag, rising abruptly from the sea to a height of 100 or 150 feet, unapproachable in rough weather, and an invulnerable castle except at one point, where we could land on a rock and climb up a steep grassy slope. Numerous black guillemots flew out from the lower crevices, and my companion, Mr. Donald B. MacMillan, succeeded in finding a few of their eggs still fairly fresh. Rev. Walter W. Perrett, of Nain, had taken a set of duck hawk's eggs from the cliffs earlier in the season. The upper part of the rock was occupied by the gulls, where their nests were mostly on inaccessible ledges. Near the top of the rock, which was flat and covered with grass, we found quite a number of nests that we could reach, but all of these were empty. Below us we could see nests containing young of various ages and one nest still held two eggs. Some of the young were nearly ready to fly and probably some had already flown. The nests were made of soft grasses and mosses, and were not very elaborate or very bulky for such large gulls; probably they had been somewhat trampled down by the young.

Kumlien (1879) found the glaucous gull breeding abundantly in the Cumberland Sound region. He describes one nesting site as "an enormous cliff about 1½ miles in length and over 2,000 feet in height, and nearly perpendicular. This cliff is about 4 miles from the seashore to the east-northeast of America Harbor. Many hundreds of nests are scattered about on the little projecting shelves of rock, and the birds sitting on them look like little bunches of snow still unmelted on the cliff. The ascent to this locality is very laborious; but the marvelous beauty of the place will well repay any future explorer to visit it, for the plants that grow in such rich profusion at the base of the cliff, if nothing more." He also says:

> I have examined some nests that were built on the duck islands, always on the highest eminence. The structure seemed to have been used and added to for many years in succession, probably by the same pair. In shape they were pyramid-formed mounds, over 4 feet at the base and about 1 foot at the top, and nearly 2½ feet in height. They were composed of every conceivable object found in the vicinity, grass, seaweed, moss, lichens, feathers, bones, skin, egg shells, etc.

Regarding the breeding habits of this species in Greenland, Mr. J. D. Figgins writes me that on Saunders Island:

> The nest is composed of moss and grass, often of considerable height because of the yearly repair, always near the top of the cliffs and never approachable from below. The nests are rarely placed other than near rookeries of murres and other gulls, where the glaucous gulls prey upon the eggs and young. When the gulls make forays upon the murre and kittiwake rookeries, the latter birds make no defense whatever and, besides uttering their usual querulous complaints, offer no resistance, seemingly knowing that it is quite useless. The glaucous gulls prefer small young, which their advanced young gulp whole. Young in various stages of growth, from newly hatched to those ready to leave the nests, were found abundantly on August 15. No eggs were seen at that time. Both adults were invariably nearby, screaming protest when the nest was approached and following the intruder for considerable distance when leaving.

On the Arctic coast of Mackenzie, Macfarlane (1908) found some 20 nests of this species on sandy islets in the bays and rivers:

> The nest was usually a shallow depression in the beach, while in one of them we discovered an egg of the black brant which was being incubated by a bird of this species.

Nelson (1887) describes two nests found by him on the Yukon delta, as follows:

> On June 4 their first nest was found. It was placed on a small islet, a few feet across, in the center of a broad shallow pond. The structure was formed of a mass of moss and grass piled up a foot or more high, with a base 3 feet across and with a deep central depression lined with dry grass. There was a single egg. The female, as she sat on the nest, was visible a mile away, and not the slightest opportunity was afforded for concealment on the broad surrounding flat.

> On June 15, near St. Michaels, another nest was found, an equally conspicuous structure. Like the majority of their nests found by me, it also was located on a small islet in a pond. It was 2 feet high, with a base from 3 to 4 feet long by 2 wide and measured about 18 inches across the top. In the apex was a depression about 5 inches deep and 9 inches in diameter. This bulky structure was made up of tufts of moss and grass rooted up by the birds' beaks. The ground looked as though it had been rooted up by pigs in places near the nest and on the outer edge of the pond; and while I was examining the nest, which contained three eggs, one of the old birds came flying up from a considerable distance, carrying a large tuft of muddy grass in its beak and dropped it close by on seeing me. One of the eggs taken was white, without a trace of the usual color marks. While I was securing the eggs the parents swooped down close to my head, uttering harsh cries.

On July 7, 1911, I visited Walrus Island, in the Pribilof group in Bering Sea, where among all the hordes of water fowl that breed in this wonderful islet was a nesting colony of glaucous-winged and glaucous gulls. Their nests were scattered among the tufts of short, coarse grass, which covered the highest and central part of the island, where soil had been formed by the accumulation of guano. The nests were rather bulky and well made of seaweed and soft grasses; a few of them still contained eggs, but nearly all of the young had hatched and were hiding in the grass and among the rocks. We were not allowed to shoot any birds here and the gulls were too shy to enable us to identify any nests, but I am positive that both species were breeding here. The glaucous-winged gull seems to have been overlooked by some of the others who have visited this island, though it may not have been breeding there then.

Eggs.—As with most gulls, only one brood is raised in a season and the set usually consists of three eggs, though two eggs frequently complete the set. The eggs are similar to those of other large gulls, varying in shape from ovate to elongate ovate. The shell is rather coarsely granulated and without luster. The ground color shows the usual variations from "buffy brown" to "deep olive buff" or "pale olive buff." The eggs are usually not very thickly and more or less irregularly spotted with small spots or blotches of various shades of the darker browns, such as "bone brown," "bister," or "Saccardo's umber"; also sometimes with lighter browns and often with underlying spots of various shades of the lighter drabs and lavender grays. The measurements of 56 eggs in the United States National Museum average 75.8 by 52.4 millimeters; the eggs showing the four extremes measure **85.5** by 50.5, 78 by **57**, **70** by 52.5 and 76.5 by **48** millimeters.

Young.—Both Turner (1886) and Elliott (1875) give the period of incubation as about three weeks, but probably four weeks would be more nearly correct; Evans (1891) gives it as 28 days. Probably both sexes incubate, for the pairs keep together at this time, and the male usually stands guard near the nest while the female is incubating. The young leave the nest after a few days and become quite lively; they are expert at hiding under whatever shelter they can find, often lying flat in some slight hollow with the eyes tightly closed. Kumlien (1879) says that he "had an opportunity of seeing how these young hopefuls are instructed in egg sucking. The parent carried a duck's egg to the nest and broke a hole in it, and the young one just helped himself at his leisure. After the young are full-fledged these birds are eminently gregarious, and are often seen feeding in considerable flocks." The young are voracious feeders and become very fat, when they are much esteemed by the natives for food.

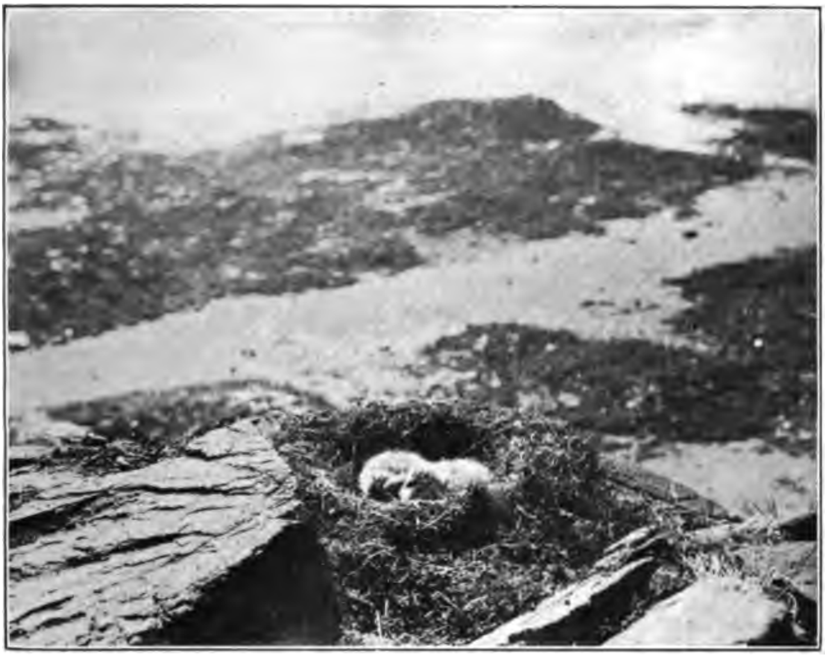
Plumages.—The young chick is covered with long, soft, thick down, grayish white above and almost pure white below, tinged with buff on the throat and breast. The back is clouded or blotched with "smoke gray," and the head and throat are distinctly marked with numerous large and small spots of "fuscous black," the number and extent of the markings varying in different specimens. Before the young bird is half grown the juvenal plumage begins to appear, about the last of July, showing first on the wings, scapulars, flanks, and back.

Doctor Dwight (1906) has given us a full and accurate account of the molts and plumages of this species. Of the juvenal plumage he says:

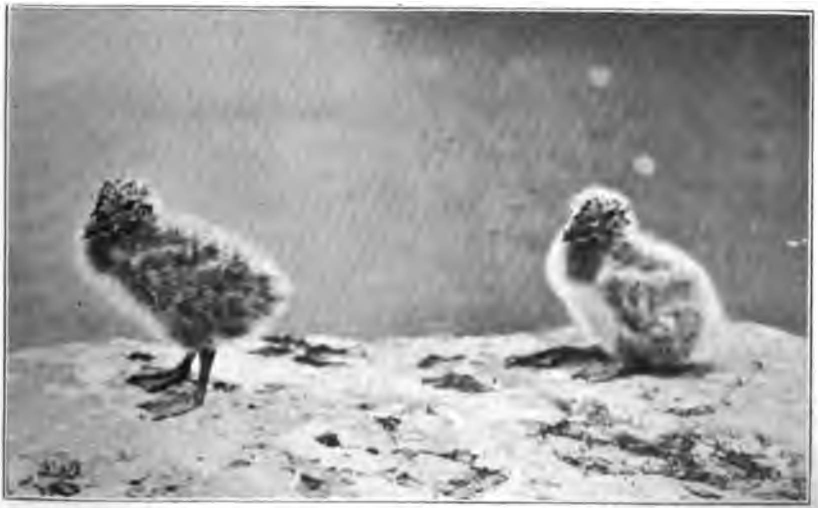
> August or early September finds birds wholly in the brown barred or mottled plumage, of which the flight feathers and the tail are retained for a full year, the body plumage and some of the lesser wing coverts being partially renewed at two periods of moult, the post juvenal in November or later and the prenuptial beginning often as early as the end of February.

The first winter plumage only partially supplants the juvenal, "chiefly on the back. The overlapping of the post-juvenal and prenuptial moults obscures the question of whether all young birds pass through one or two moults during their first winter, but the evidence is in favor of two. Before the time of the prenuptial arrives birds have faded out a good deal and are often quite white in appearance, with the brown mottling very obscure. The paler of the drab primaries apparently fade to white in some cases." At the first postnuptial molt in August and early September, when the bird is 14 or 15 months old, a complete change takes place, producing the lighter but still mottled plumage of the second year. There is, however, great individual variation in the purity of this plumage, some birds still retaining mottled feathers like those of the first year and others acquiring advanced signs of maturity. Doctor Dwight (1906) says further:

> In a very few birds brown mottled feathers still predominate, although birds with fairly developed gray mantles, white tails sprinkled with brown, and having pale ecru-drab or white primaries are perhaps the most usual type of



Sulwuddy, Greenland. D. B. MacMillan.



Cape Kendrick, Greenland. D. B. MacMillan.

GLAUCOUS GULL.

FOR DESCRIPTION SEE PAGE 330

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> plumage. The white heads and bodies are much obscured with smoky gray. An extreme is represented by birds absolutely pure white, the "*hutchinsii*" type. The dark bill of the young bird is replaced by a bill which is partially yellow. A partial prenuptial moult occurs in April, producing the second nuptial plumage, in which some birds, except for wings and tail, are now like adults.

The adult winter plumage is acquired by a complete postnuptial molt, in August and September, when the bird is 26 or 27 months old. This plumage is characterized by the pure white head and body plumage, pale pearl-gray mantle and wings of the same shade, fading to white at the tips of the remiges. A few birds still retain traces of immaturity, such as an occasional mottled feather or some signs of dusky clouding on the head, which disappear at the third partial prenuptial molt. In the complete postnuptial molt the remiges are shed in pairs, in regular rotation, beginning with the inner secondary and ending with the outer primary.

Food.—The glaucous gull is noted for its ravenous appetite, for it is a voracious feeder and is not at all particular about its diet, which includes almost any kind of animal food whether fresh or carrion. Its fresh food consists of fish or mollusks, which are usually stolen from other sea birds, starfish, sea-urchins, surface-swimming amphipods and crustaceans, and the eggs and young of other sea birds. Yarrell (1871) says that "it feeds also on *Cancer pulex* and *araneus;* extracts the soft animals from the shells of *Venus islandica*, *Pecten islandicus*, and searches closely for the lump-sucking fish, *Cyclopterus lumpus*." That it is not content with devouring the eggs and young of dovekies, murres, and other small sea birds is shown by the much quoted statement by Swainson and Richardson (1831) that "one specimen killed on Captain Ross's expedition, disgorged an auk when it was struck, and proved by dissection to have another in its stomach." As a consumer of carrion it is undoubtedly useful; it feeds freely on dead fish or other animal refuse, which it finds along the shore, the entrails of fish, which are thrown overboard, the carcases of seals and the remains of animals or birds killed by hunters. Murdoch (1885) says:

> If a duck be shot so that he fall in the water or any not easily accessible place, an hour is generally time enough for him to be reduced to a skeleton by the gulls.

Nuttall (1834) states that they "are said to attend on the walrus to feed on its excrement"; also that when "pressed by hunger," they sometimes even condescend to share the crow berry with the ptarmigan. Hagerup (1891) observes that "after the young leave their nests in August they gather on the flat tracts along the shore and feed on the berries of *Empetrum nigrum*, of which they consume a vast quantity."

Behavior.—The flight of this gull is not especially different from that of other large gulls, though it is particularly strong and at times quite swift, as when chasing the smaller sea birds to rob them of their food. The white-tipped wings serve to distinguish it from all other gulls except the Iceland gull, from which it differs only in size—a very unsatisfactory field mark. Even in young birds the primaries are much whiter than in other species, so that on the Pacific coast the glaucous gull can usually be recognized at short range.

Its voice is usually loud and harsh, often shrill and penetrating, but on its breeding grounds I have heard it utter a variety of soft conversational notes after the first excitement was over. Nelson (1887) gives us a good description of its notes as follows:

> They have a series of hoarse cries like the syllables ku-ku-ku, ku-lee-oo, ku-lee-oo, ku-lee-oo, ku-ku-ku, ku-ku-ku. The syllables ku-ku are uttered in a hoarse nasal tone; the rest, in a shrill, screaming cry, reaching the ear at a great distance. These notes are used when quarreling or communicating with each other, and when disturbed on their breeding ground. At Unalaska, during May, 1877, I found them about the cliffs on the outer face of the island, and they protested vigorously against our presence as they glided back and forth overhead or perched on craggy shelves.

Elliott (1880) says:

> It has a loud, shrill, eaglelike scream, becoming more monotonous by its repetition; and it also utters a low, chattering croak while coasting.

Turner (1886) observes:

> The note of this bird is variable; in spring a harsh *Kaou*, which changes to a deep *honk*, in a few weeks. When flying along the shore a prolonged, grunting croak is uttered.

Chamberlain (1891) gives it as "something like the syllables *Kuk-lak;* I have seen it written *cut-leek.*"

I quote from Mr. Hersey's notes his observations on the behavior of this species near St. Michael:

> The glaucous gull is a bird of marked individuality. Though often solitary, when a number do assemble together they are usually rather noisy. A large flock has kept close to the ship for several days while we have been anchored in the bay and this gave me a good opportunity to study them. Often while all were resting quietly on the water one would extend his neck, open his mouth to its widest extent, and swim rapidly along, voicing his wild harsh notes. Sometimes he would swim in circles while calling, or two birds would swim side by side, either in a straight course or circling. At other times they would face one another on the water, or when on the wing one would rise above the other, the lower bird stretching his neck up and the other reaching downward, and both with dangling legs and motionless wings cry lustily. At one time while two birds were struggling with a piece of food two others sat on the water near by and added their cries to the general commotion. Both adult and immature birds do this.
>
> They are strong swift fliers, and probably pugnacious toward smaller or weaker species, but I did not see them molest any other birds, although

I often noticed that the Sabine's and short-billed gulls, Pacific kittiwakes and jaegers kept at a respectful distance and never attempted to pick up food from the water if these gulls were near but left it for them. When no food was in sight all the above species rested on the water together in one flock. When food was thrown out the glaucous gull was slower in taking wing than the others and often lost his share on this account.

The glaucous gull is decidedly predatory in its habits. Nuttall (1834) says:

> They wrest prey from weaker birds, and are often seen hovering in the air or seated on some lofty pinnacle of ice, whence, having fixed their eye upon some favorite morsel, they dart down on the possessor, which, whether fulmar, guillemot, or kittiwake, must instantly resign the prize. The auk, as well as the young penguin, they not only rob but often wholly devour.

Kumlien (1879) gives the following account of how it robs the eiders:

> June 4, I saw a few *L. glaucus* among a large flock of *Som. mollissima* that were diving for food outside the harbor in a small lead in the ice. As soon as the duck came to the surface the gull attacked it till it disgorged something, which was immediately gobbled up by the gull. The gull picked several times at what was disgorged, which leads me to the belief that the food was small crustaceans. This piratical mode of living is very characteristic of *Larus glaucus*.

A similar performance has been noted by Hagerup (1891) in Greenland.

The Eskimos find the breasts of this and other gulls desirable as food, the young birds being considered a delicacy, and the eggs are very good to eat when fresh. Many an Arctic explorer also has found these birds a welcome addition to the food supply. Kumlien (1879) thus describes the primitive methods of the Eskimos in capturing these birds:

> One of the most popular is to build a small snow hut on the ice in a locality frequented by the gulls. Some blubber or scraps of meat are exposed to view on the top and seldom fails to induce the bird to alight on the roof of the structure. This is so thin that the Eskimo on the inside can readily see the bird through the snow and, with a quick grab, will break through the snow and catch the bird by the legs. Some use a spear, thrusting it violently through the roof of the hut. Many are killed by exposing pieces of blubber among the hummocky ice and lying concealed within proper distance for bow and arrow practice.

Murdock (1885) tells us of another method practiced at Point Barrow:

> They are a favorite bird with the natives, and many are shot in the autumn as they fly up and down the shore. They are also occasionally caught with a baited line in the autumn when there is a light snow on the beach. A little stick of hardwood, about 4 inches long and sharpened at both ends, has attached to its middle a strong line of deer sinew. The stick is carefully wrapped in

blubber or meat and exposed on the beach, while the short line is securely fastened to a stake driven into the sand and carefully concealed in the snow. The gull picks up the tempting morsel and swallows it and, of course, is caught by the stick, which turns sidewise across his gullet, and his struggles to escape fix it more firmly.

Winter.—Although some individuals, principally young birds, remain as far north as Greenland in winter, the great majority of these gulls migrate southward when the sea ice freezes, and their feeding grounds are covered with ice and snow, but winter must be well upon us before we need look for them on the New England coast. They are always rare here and find the southern limit of their normal winter range about Long Island. When on our coasts they may be seen among the flocks of herring gulls which frequent our harbors and beaches, acting as scavengers, intent only on finding a good food supply. McIlwraith (1894) says:

> During the winter months the "burgomaster," as this species is usually named, may be seen roaming around the shores of Lake Ontario, seeking what it may devour, and it is not very scrupulous either as regards quantity or quality.

On the Pacific coast it winters as far south as Monterey, associating with the common winter gulls of that region.

Many years ago Mr. Ridgway (1886) described the glaucous gulls of the coasts of Alaska and adjacent waters as a new species under the name *Larus barrovianus*, the size and the shape of the bill being the chief distinguishing character. Twenty years later Doctor Dwight (1906) argued that this species was untenable, and it was removed from the check list. Recently, however, Dr. H. C. Oberholser (1918) has resurrected *barrovianus*, as a subspecies of *hyperboreus*, on the claim that the Alaska bird is smaller and has a darker mantle than the birds from Greenland or from Europe. Whether this claim is well founded or not, it is apparently a fact that the characters he ascribes to the Alaska bird hold true in a large majority of the specimens, though there are some exceptions to the rule. Doctor Dwight, however, still maintains that the proposed race is unworthy of recognition in nomenclature.

DISTRIBUTION.

Breeding range.—Circumpolar, including practically all the Arctic coasts and islands of both hemispheres. In North America south to eastern Labrador (Cape Harrison), Newfoundland (west coast and in the interior), James Bay (east side), northern Hudson Bay (Cape Fullerton), Arctic coast of Canada and Alaska, Bering Sea coast of Alaska (south to the Kuskoquim River) and Pribilof Islands (Walrus Island). North on all the Arctic islands and northern Greenland to at least latitude 82° 34′ North. In the eastern hemisphere from Spitzbergen and Nova Zembla eastward to northeastern Siberia and Wrangel Island. South to Iceland, Arctic coasts of Europe and Asia and to Kamchatka.

Breeding grounds protected in the following national reservations in Alaska: Bering Sea, St. Matthew Island; Pribilofs, Walrus Island.

Winter Range.—In North America south along the coast fairly regularly to Massachusetts and Long Island and casually farther south. In the interior rarely to the Great Lakes (Lakes Ontario and Michigan). And on the Pacific coasts south to central California (Monterey) and Japan, rarely to the Hawaiian Islands. In Europe south to the Azores and the Mediterranean, Black, and Caspian Seas. North to limits of open water.

Spring migration.—Early dates of arrival: Southern Greenland, March 20; northeastern Greenland, latitude 80° 20′ North, June 9; Baffin Land, Kingwah Fiord, April 20; Fort Conger, May 14; King Oscar Land, May 27; Prince Albert Land, May 31; Winter Harbor, June 3; Wellington Channel, May 16; Alaska, Yukon Delta, May 13; Kowak River, May 11; Point Barrow, May 11; and Demarcation Point, May 14. Late dates of departure: Long Island, Rockaway, May 1; Massachusetts, Rockport, April 24; Maine, Portland, April 27; Quebec, Godbout, April 29; California, Monterey, May 4; Washington, Tacoma, May 2.

Fall migration.—Early dates of arrival: Massachusetts, Cambridge, November 29; Long Island, Orient, November 30; California, Monterey, November 6. Late dates of departure: Ellesmere Land, Cape Union, September 1; Greenland, Thank God Harbor, September 3, and Bowdoin Bay, October 17; Mackenzie River, October 9; Alaska, Point Barrow, November 1; Kotzebue Sound, October 13; Unalaska, November 12; Diomede Islands, December 7; Pribilof Islands, December 13.

Casual records.—Wanders in winter along Atlantic coast to North Carolina (Cape Lookout, Carteret County, March 30 or 31, 1895), and to Bermuda (April 28, 1901). Accidental at many places in the interior, westward to Wisconsin (Milwaukee, January 8, 12, and 14, 1895), and southward to Texas (Clay County, December 17, 1880).

Egg dates.—Canadian Arctic coast: Twenty records, June 10 to July 8; ten records, June 25 to July 5. Northern Alaska: Eleven records, May 26 to June 28; six records, May 30 to June 12. Greenland: Nine records, May 26 to July 2; five records, June 7 to 14. Iceland: Ten records, May 12 to June 21; five records, June 1 to 10. Newfoundland: Three records, June 3, 5, and 8.

LARUS LEUCOPTERUS Faber.

ICELAND GULL.

HABITS.

Contributed by Charles Wendell Townsend.

The Iceland gull is a smaller edition of the glaucous gull, which it resembles closely in appearance and habits. Like its larger relative it breeds in the Arctic regions in Victoria Land, Boothia Peninsula, Greenland, Iceland, and east to Nova Zembla. It winters wherever there is open water in its range and south to Long Island and the British Isles. In the interior it is rare. Rather more arctic in its distribution than the glaucous gull, it seldom comes as far south in winter.

Nesting.—The Iceland gull nests in communities by itself and with other species of gulls both on high rocky cliffs and on low, sandy shores. Ross (1835) found it breeding on the faces of precipices on the shores of Prince Regent's Inlet with the glaucous gull, "but at a much less height and in greater numbers." Hagerup (1891) at Ivigtut in Greenland says:

> About a thousand pair nest on the "bird cliff," above the kittiwakes. The lowest nests are built at a height of about 200 feet; the highest at about 500 feet above sea level. In 1888 a single pair hatched their young away from the rest on the face of the cliff, close by the edge of the ice, and at the height of 40 feet. Two pair raised their young during the three summers I was in Greenland on a cliff which was formerly the home of numerous kittiwakes. One of these nests was at the height of 15 feet, the other 100 feet above sea level.

He writes that the birds arrive in March and often lay their eggs while the fiord below is still covered with ice. The earliest young leave their nests at the close of July.

The nest is rather a bulky affair, made up of mosses and grasses. One set of eggs is laid, either two or three in number.

Eggs.—The eggs are of a clay color with numerous chocolate-colored markings. They are exactly like those of *hyperboreus*, but smaller. The measurements of 54 eggs, in various collections, average 68 by 48 millimeters; the eggs showing the four extremes measure 75.5 by 49.5, 72.5 by 51, 62.5 and 49.6, and 65.7 by 44.7 millimeters.

Plumages.—The downy young are dingy white, with brownish-gray spots above, especially about the head. In July and August they are feathered out in the juvenal plumage, which is white, more or less barred and mottled above with black and brown. Below they are gray with indistinct cloudings. Dwight (1906) says of this stage that "the primaries more frequently have white or brownish shafts, untinged with the yellow, so prominent in *glaucus*." Kumlein (1879) says that the first plumage of the young is darker than that of the yearling bird, while the opposite is the case in *glaucus*. According to Dwight (1906), "the sequence of molts and plumage is precisely the same as in the larger *glaucus*, of which it is a small edition. There is, however, no overlapping of dimensions, for even the largest male fails to reach the size of the smallest female *glaucus*." The first winter plumage resembles the juvenal, and is acquired by a partial postjuvenal molt. In this plumage the bird looks white, but rather soiled and buffy or coffee-stained in places. There is considerable variation, and in some individuals the mottling is quite dark. After the first postnuptial molt the bird loses much of its mottling and becomes nearly white, the *candidus* and *glacialis* of early writers corresponding to the *hutchinsii* of the glaucous gull. Dwight says that "second-year birds more often have adult mantles than do second-year *glaucus*, but the creamy or pinkish drab, or white primaries and brown mottled feathers in wings of tail, betray their age." The full adult plumage is assumed in the third winter, and is characterized by a pearl-gray mantle and pure white color of head, breast, tail, and the tips of all of the wing feathers. The bill is yellow. According to Dwight the color of the mantle is somewhat darker than that of *glaucus*. This stage is rarely seen on the New England coast, although full adults of the glaucous gull are not uncommon.

The recognition of a white-winged gull in the field is not difficult. The general whiteness of the birds as compared with herring gulls, for example, makes them conspicuous. In all cases where the diagnosis is suspected it is necessary to examine carefully the wing tips with the glasses before one can speak with certainty. The entire absence of dark markings on the wing tips at once settles the general diagnosis, but it is often extremely difficult to differentiate between the glaucous gull and the present species. Particularly is this the case if a white-winged gull is seen alone or with others of the same species. Size in absence of other objects for comparison is very deceptive. In company with the glaucous or the herring gull, the Iceland gull is seen to be a little smaller. The glaucous gull is not only larger than the Iceland gull, but is also larger than the herring gull; but here again appearances without careful comparison are apt to be deceptive. In fact, size alone is of little value, for a large male Iceland gull may nearly equal in size a small female glaucous gull. The size of the head, neck, and bill are, however, important field marks, for these are noticeably smaller in proportion to the size of the bird in the Iceland gull than in the glaucous gull.

Food.—The feeding habits of the Iceland gull are similar to those of the glaucous and herring gulls. They are ever on the alert to pick up dead fish, crustacea, or other edible substance from the surface of the water and from the beaches. About Eskimo encampments seal and fish refuse are eagerly sought. Hagerup (1891) states that in Greenland the young feed on the berries of *Empetrum nigrum.* He also says:

> For a while after leaving the nests they are accompanied by one of the parents, or by both, and these give warning in a wise and unmistakable manner: "Don't go near those treacherous boats," they seem to cry. Later on the young mingle with the young of the glaucous gull, but not with young kittiwakes. In voice and habits the young birds quite resemble young glaucous gulls.

Behavior.—Like other gulls and terns the Iceland gull is sometimes of value to man in indicating the presence of fish. Baird, Brewer, and Ridgway (1884) quote from Faber a statement that in 1821 "on the 1st of March the shore was full of sea gulls; but early on the 2d the air was filled with numbers of this species which had arrived during the night. The Icelanders concluded from the sudden appearance of the birds that shoals of codfish must have arrived on the coast, and it was soon found that this conjecture was correct." He adds that these gulls "would indicate to the seal shooters in the fiord where the seals were to be looked for, by following their track to the sea and hovering over them in flocks with incessant cries." In both cases it is probable that the larger creatures stirred up the water so that the smaller food of the gulls could be obtained. In the same way flocks of terns follow whales, not with any expectations of feeding on the whale, but on the smaller marine life stirred up by the whale and on which both feed.

Winter.—Iceland gulls, as well as glaucous and Kumlien gulls, visit the New England seacoast more in some than in other winters, dependent, no doubt, on the amount of open water and on the sufficient or insufficient food supply in the north. In the winter of 1907 and 1908 we were favored with an unusually large number of these northern birds in the vicinity of Boston. F. H. Allen (1908) reported one or two Iceland gulls in immature plumage in Charles River Basin and in Boston Harbor, at least three at Swampscott, and one at Lynn and Marblehead.

DISTRIBUTION.

Breeding range.—Portions of the Arctic regions; from Victoria Land (Cambridge Bay), Boothia Peninsula, and west-central Greenland east probably to Nova Zembla; southern limits not well defined. Said to breed in Hudson Bay. Mackenzie Bay and other western records are not well established and should be discredited.

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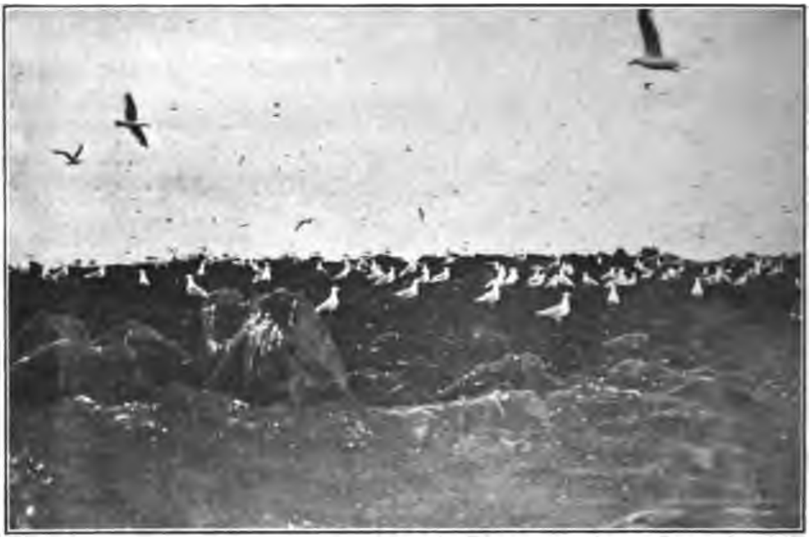
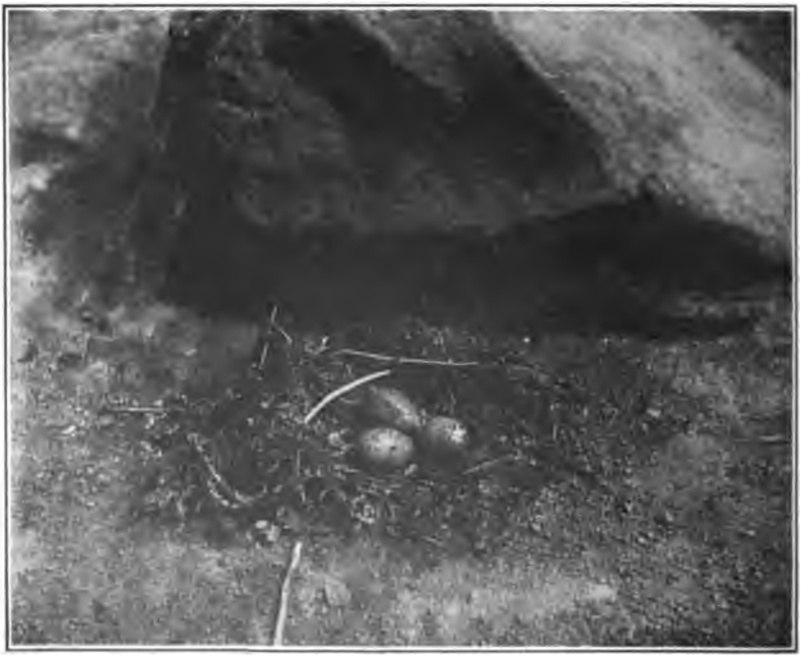


Walrus Island, Alaska. A. C. Bent.



Bogoslof Island, Alaska. A. C. Bent.

GLAUCOUS-WINGED GULL.

FOR DESCRIPTION SEE PAGE 330.

Winter range.—From the northern limits of open water in southern Greenland south along the Labrador coast to the Bay of Fundy and Maine, more rarely Massachusetts and Long Island. Occasionally on the Great Lakes as far west as Michigan (Sault Sainte Marie). Recorded off North Carolina (Cape Hatteras). In Europe from Iceland, the northern British Isles, and Scandinavia south; rarely to northern France and the Baltic Sea.

Spring migration.—Early dates of arrival: Ellesmere Land, Fort Conger, May 19 to June 5; northeastern Greenland, June 20. Late dates of departure: New York, Rochester, April 14; Maine, Portland, April 27, and Richmonds Island, May 20; Ontario, Port Sidney, April 6; Quebec, Godbout, May 1.

Fall migration.—Early dates of arrival: Massachusetts, Boston, November 4; New York, Lansingburg, November 21. Late dates of departure: Northeastern Greenland, September 25 to 30; Gulf of Cumberland, September 6.

Casual records.—Accidental in Maryland (Baltimore, November 23, 1893) and at various places in the interior, as far west as Nebraska (Dorchester, January 15, 1907). Two specimens taken at Point Barrow, Alaska, August 4 and September 19, 1882.

Egg dates.—Iceland: Eleven records, May to July 2; six records, June 6 to 28. Greenland: Nine records, May 29 to July 1; five records, June 10 to 20.

LARUS GLAUCESCENS Naumann.

GLAUCOUS-WINGED GULL.

HABITS.

This, the most abundant, the most widely distributed, and the characteristic gull of the north Pacific coast, is an omnipresent and familiar sight to the travelers along the picturesque coast and through the numerous inside passages leading to Alaska. From the coast of Oregon southward it is replaced by the dark-mantled western gull during the breeding season, and in Bering Sea it mingles with the large white Arctic species, the glaucous gull, by which it is replaced northward. During the latter part of April, in 1911, we first became familiar with the glaucous-winged gull in Puget Sound, where it was very abundant, feeding with the herring gull in large numbers about the harbors. As we steamed northward in May through various channels and sounds to Ketchikan, Alaska, the grand and picturesque scenery of those inside passages was enlivened and made more attractive by the constant presence of these gulls following the ship, drifting northward to their breeding grounds, or merely wandering in search of food. At Ketchikan they were particularly abundant in a great variety of plumages of different ages. But when we passed through Dixon Entrance and out into the Pacific Ocean we left the gulls behind, as the land faded away from sight, and when 50 or 100 miles from land they had been replaced by the more pelagic fulmars and albatrosses. We did not see them again until we came within sight of the Aleutian Islands, and from that time on they were always with us throughout the whole length of the Aleutian chain.

Spring.—As this gull is practically resident, or, at least, always briefly a few typical breeding colonies in different localities. present throughout all but the extreme northern portions of its breeding range, it is difficult to tell just when it arrived on its breeding grounds; but it usually begins to frequent or to resent intrusion upon its nesting grounds at least a fortnight before egg laying begins, the dates varying greatly in the different latitudes. To illustrate the wide variations in its nesting habits I propose to describe

Nesting.—The largest and most interesting colonies of the glaucous-winged gull, in the southern part of its range, are among the spectacular sea-bird colonies on the rocky islands set apart as reservations off the coast of Washington, and divided into three groups, known as the Copalis Rock Reservation, the Quillayute Needle Reservation, and the Flattery Rocks Reservation. Mr. W. Leon Dawson (1908*a*) and Prof. Lynds Jones visited the various islands in these groups in 1905 and 1907, and made careful estimates of the numbers and kinds of birds found breeding there. The full report is well worth reading to gain a fair impression of what these wonderful reservations contain, but I shall confine my quotations to a few striking facts taken from it. Only two pairs of glaucous-winged gulls were found nesting on Destruction Island, which seems to be the southern limit of its breeding range. Thence northward, colonies of this species became more frequent and increased in size. The largest colony was found on Wishalooth Island, from 2,000 to 3,000 glaucous-winged gulls, 100 to 500 western gulls, 1,000 tufted puffins, 5,000 to 15,000 Kaeding's petrels, and 100 Baird's cormorants. This is an island of about 20 acres, three-quarters of a mile offshore in the Quillayute Needles Reservation. It is "a lofty jagged ridge of metamorphic conglomerate with sharply sloping sides covered with guano ledges and resulting areas of shallow earth, which are clothed with grass and other vegetation—yarrow, painted cup, and the like; 175 feet high; 200 yards long along the crest." Carroll Islet, "the gem of the Olympiades," as Mr. Dawson calls it, contained the following wonderful colonies of breeding water birds: Five thousand tufted puffins, 1,000 Cassin's auklets, 20 pigeon guillemots, 700 California murres, 1,000 glaucous-winged gulls, 50 western gulls, 500

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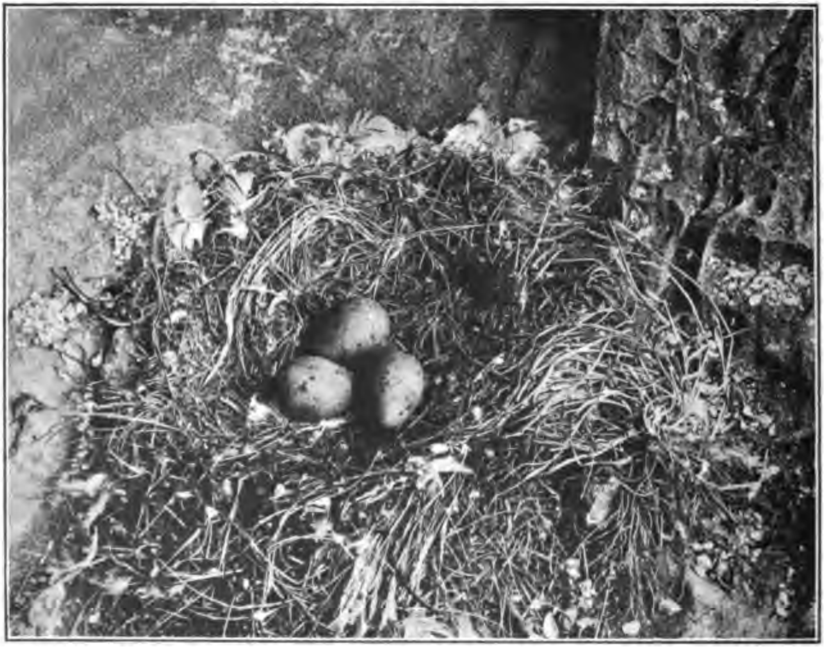
Flattery Rocks, Washington. W. L. Dawson.



Carroll Islet, Washington. W. L. Dawson.

GLAUCOUS-WINGED GULL.

FOR DESCRIPTION SEE PAGE 330.

Kaeding petrels, 100 white-crested cormorants, and 500 Baird's cormorants. Professor Jones (1908) has well described it, as follows:

> Seaward Carroll Islet presents a rock precipice some 200 feet in height. A stone dropped from the top, within 2 rods of our camp, would fall clear into the ocean below. Landward the islet slopes at first gently, but finally at an angle of nearly 70° to within 30 feet of the water, ending in another precipice there. It was only along the landward side that ascent was possible, and even there one must clamber up vertically for 10 or more feet, finding foothold in the weathered rock. Two sharp rock ridges jut out, one at the northeast corner, the other landward easterly. The gentler slope of the top is covered with Sitka spruce trees, two of them old monarchs, with a few deciduous trees, growths of elder bushes, a sort of red raspberry bush, and the ever-present salal bushes. Bordering on the steeper slopes there is a growth of grass clinging to masses of soil which has lodged in the interstices between rock chips. In some places this grass is seen clinging to shelves on the face of precipices. Exposed rock faces are pitted and hollowed by the elements into nesting places for cormorants and gulls. Other rock masses, a good deal worn down, project from the other angles of the island. The waves have worn a hole completely through the island parallel to the landward side and about a hundred feet from it. Practically the entire island was covered by the nests of this species, except the area covered by the taller trees, and also a relatively small area on the steep slope of the northeastward side.
>
> By covered is meant that there were nests in all sorts of situations and within reasonable distance of each other, but never within striking distance of the birds occupying adjoining nests. A number of nests were found beneath the dense fringe of salal bushes, and many of the larger grottoes of the perpendicular rock faces contained a nest. Ledges, which were broad enough to afford us secure footing, were also occupied by nests. Often nests could be seen on small niches in the rocks. There was one nest on the murre ledge fully exposed on the bare rock. Many of the more exposed nests showed unmistakable signs of having been pilfered by crows.

Professor Jones noticed that all of the gulls which were nesting under the bushes were old birds with pure white heads, while many of those nesting in the open showed signs of immaturity. The nests were also better made than those in the open.

We found this species nesting under somewhat different conditions in the Aleutian and Pribilof Islands, where it was decidedly the commonest large gull and universally distributed. On Bogoslof Island on July 4, 1911, we found a colony of between 100 and 200 pairs of glaucous-winged gulls nesting on the flat sandy portions of the famous old volcano. The steep, rocky pinnacles in the center of the island were densely populated by countless thousands of Pallas's murres. Recent eruptions had thrown up so much volcanic dust, ashes, and sand that extensive sand dunes and flat sandy plains had been formed all around the island, which was entirely bare of shelter and devoid of vegetation. The nests of the glaucous-winged gulls were widely scattered over this area, no two being anywhere near together. They were well made of seaweed, rockweed, kelp, and straws, and were sometimes decorated with feathers or fish bones; some of the nesting material must have been carried a long distance, for the nearest land on which any grass was growing was many miles away. Many of the eggs were pipped and there were quite a number of downy young running about, but a few of the eggs were only slightly incubated. The nesting grounds of the gulls were closely adjacent to a large breeding rookery of Steller's sea lions (*Eumetopias stelleri*), with which they seemed to be on friendly terms.

A few days later we landed on Walrus Island, the most wonderful bird island in North America. Here we found a breeding colony of this species mixed with glaucous gulls on the highest part of the island, where the accumulations of guano had formed a rich soil, supporting a luxuriant growth of grass. Other portions of the little island, which I have described more fully in the history of the red-faced cormorant, contained, in close proximity to the gulls, the most densely populated colonies I have ever seen of California and Pallas's murres, tufted puffin, paroquet, crested and least auklets, Pacific kittiwakes, and red-faced cormorants. At the time of our visit (July 7, 1911) most of the gulls' eggs had hatched, but a few eggs were still to be seen in the nests among the tufts of grass. Mr. William Palmer (1899) says of the nests on these islands:

> On Walrus Island the nests are quite numerous. On June 13 many contained three eggs well incubated; some had two fresh eggs, while a few had one or two young and an egg or two. Larger young were picked up on the rocks near the nests. The nests are well made, clean, and are generally composed of dead grass stems, which the birds bring from St. Paul. While most were placed on the flat rock, a few were in depressions of the sand which filled some of the larger crevices of the rocks.

Dr. E. W. Nelson (1887) says:

> The usual nesting places of this species are the faces of rugged cliffs, at whose base the waves are continually breaking and the coast exposes its wildest and most broken outline.

He seems to think that instances of these gulls nesting in other situations are exceptional. They nest on the steep, rocky cliffs of St. George Island and in similar situations elsewhere, but they also nest frequently on the flat, grassy tops of many small islands, and are found on the sandy plains of Bogoslof Island. We never found them nesting on the larger islands in the Aleutian chain, where they might be disturbed by foxes. On June 19, 1911, I saw a large number of glaucous-winged gulls frequenting a high grassy plain on Kiska Island and acting as if they were breeding in the vicinity, but I could not find any nests.

Eggs.—The glaucous-winged gull normally lays three eggs, though frequently two constitute a full set; four eggs are very rarely, if ever, laid by one bird. Only one brood is raised in a season. The eggs are not distinguishable from those of other species of gulls of similar size. The prevailing shape is ovate, with variations toward short ovate on one hand and elliptical ovate on the other. The shell is thin and finely granulated, with only a dull luster. The ground color shows various shades of buff, "olive buff," and pale olive. The eggs are spotted, generally uniformly over the entire surface, with small spots or occasional larger blotches of "wood brown," "raw umber," "burnt umber," or "seal brown," and with underlying spots of "lilac gray." The measurements of 47 eggs in the United States National Museum average 72.8 by 50.8 millimeters; the eggs showing the four extremes measure **82** by 51.5, 73.5 by **55, 66** by 47.5 and 70.5 by **46.5** millimeters.

Young.—Mr. George Willett (1912) noted the following incident in the education of the young:

> I was considerably interested in observing the swimming lessons given the nearly grown young by the adult birds. In some cases, where the young seemed afraid to take to the water, they were shoved from the rocks by the old birds. The old bird would then swim beside the young one, occasionally poking it with her bill. I was unable to satisfy myself whether this was meant as a caress or as punishment for poor swimming.

Plumages.—The period of incubation does not seem to be definitely known. The downy young is "drab gray" above, variegated with "avellaneous," and a paler shade of the same color below, fading to "tilleul buff" on the center of the breast. It is heavily spotted on the back with "fuscous black" and on the head and throat with pure black. The young birds somewhat resemble those of the western gull, but the latter has more of the buffy shades and less of the gray; and the markings on the back are not quite so heavy. Perhaps in large series they might intergrade.

Dr. Jonathan Dwight (1906) has fully described the sequence of plumages in this species as follows:

> The juvenal plumage is deep plumbeous gray with broad dark barring or mottling and obscure whitish edgings. The tail is nearly solidly gray, sprinkled basally with white, and the flight feathers, including the quills, are also dark gray. Birds in this plumage are never so pale (especially the primaries) as the darkest *leucopterus*, nor are they ever so dark as the palest of the black-primaried species. They fade to a decidedly brown shade, almost mouse gray, but their color (especially that of the primaries) and the size of their bills, even when young birds, are cardinal points by which to recognize them. The first winter plumage is like the juvenal, but at the prenuptial molt white about the head and body and gray on the back begins to appear in some specimens, thus marking the first nuptial plumage. In the second winter plumage unpatterned drab or mouse-gray primaries are most frequent, together with the gray mantle of the adult. The white head and neck, as in the other species, are much clouded with dusky markings, which are lost at the next prenuptial

molt. I do not think that primaries with the apical white spots of the adult bird are ever developed until a year later, but in some birds there is a foreshadowing of the white spots on the first primary. The third winter plumage, that of the adult, is the result of the second post-nuptial molt, after which very few birds can be found showing traces of immaturity. The new primaries are slaty, and white tipped, the first and sometimes the second with subapical or sometimes terminal white "mirrors," quite unlike the unpatterned feathers of *glaucus* or the smaller *leucopterus*. The mantle varies from cinereous to plumbeous gray, the color running over into the primaries, which become decidedly slaty toward their apices. The white of the head and neck is still clouded, the dusky markings being characteristic of winter plumages until the birds are quite advanced in age. At prenuptial molts, as in the other species, these feathers are replaced by white ones.

Food.—These, like other large gulls, are useful scavengers all along the coast and are practically omnivorous. They were constantly following our ship in search of small scraps that might be picked up, and, while we were at anchor at Ketchikan and Unalaska, they were especially numerous and always in sight, eagerly waiting for the garbage to be thrown overboard. They are abundant, in winter, in the harbors of nearly all the large cities on the Pacific coast as far south as southern California, where they feed largely on refuse and seem to fill the place occupied by the herring gull on the Atlantic coast. They are particularly numerous about the garbage heaps which are dumped on the shore to be washed away by the advancing tides. In such places they appear to realize that they are protected and are very tame. In their eagerness to secure the choice morsels of food they seem to forget all about the presence of human beings, even within a few feet. At other times it is difficult for a man to walk up within gunshot distance of them. They become much excited and clamorous in their scramble for food, competing at close quarters with other species of gulls, with dogs, and with the lazy Indians. They are none too particular in their choice of food and will eat almost anything that is edible.

During the summer they frequent the vicinity of the salmon canneries, where they gorge themselves on the refuse from the factories or fishing vessels and on the bodies of dead salmon along the shores. As a result they become very fat. On the Pribilof Islands they regularly visit the killing grounds to feast on the entrails and other waste portions of the slaughtered seals, which furnish an abundant food supply. Among the Aleutian Islands, where sea urchins are abundant, we found numerous broken shells of these creatures on the rocky heights frequented by the gulls. Evidently they had been dropped on the rocks to break the shells. In the colonies, where they were nesting with other species, we saw no evidence to prove that they feed on the eggs or young of their neighbors, though they may, perhaps, do so occasionally. On Walrus Island we kept some of the murres and cormorants off their nests for several hours without any apparent damage from the gulls.

Behavior.—The flight of the glaucous-winged gull is buoyant, graceful, and pleasing, and its plumage is always spotlessly clean and neat. A gull in flight is one of nature's most beautiful creatures and one of its triumphs in the mastery of the air. It was a never-ending source of delight to watch these graceful birds following the ship at full speed without the slightest effort, dropping astern to pick up some fallen morsel or forging ahead at will, as if merely playing with their powers of flight. Sometimes the same individual could be recognized day after day by some peculiarity of marking. They seem thoroughly at ease on the wing. Several times I saw one scratch its head with its foot, as it sailed along on set wings, without slackening its pace at all. When traveling against a strong head wind I have seen one sail along for miles without moving its wings, except to adjust slightly the angle at which they were held, keeping alongside the ship, forging ahead, or dropping astern, as it wished, and rising or falling to suit its fancy. When left far astern to pick up food off the water it would give a few flaps when rising, set its wings, and soon catch up with the ship. This power to sail almost directly into the teeth of a strong wind has caused much discussion, as it has been noted in the herring gull and other species. Various theories have been advanced to account for it, all of which are more or less unsatisfactory. To my mind it is simple enough to understand if we can realize that a gull is a highly specialized, almost perfect sailing vessel, endowed with instinctive skill in navigating the air to use the forces at its command to advantage. With a clear knowledge of the forces at work when a ship sails, close hauled, to within a few points of the wind, we can imagine the gull sailing along a vertical plane, in which the force of gravity replaces the resistance of the water against the keel and the wind acts against the gull's wings as it does on the sails of the ship; the resultant of these two forces is a forward movement, which the gull controls by adjusting its center of gravity and the angle of its wings.

It is evident from the foregoing accounts that the glaucous-winged gull is decidedly a sociable species on its breeding grounds where it seems to nest in perfect harmony with its neighbors in close quarters. It also associates on migrations and during the winter with various other species of gulls, with all of which it seems to be on good terms. The adults can readily be distinguished from the white-winged species or from those having black-tipped wings by the peculiar color pattern of the primaries. Birds in immature plumage are not so easily recognized, but a careful study of the descriptions given in the manuals will help to identify them. They are not likely to be confused with the dark-mantled western gull, but Mr. Dawson's (1908) reference to the large number of "mulattoes" on Carroll Islet suggests the possibility that these two species may hybridize.

Mr. Dawson (1909), who spent a week studying the vocal performances of this species and their significance, has thus classified its various notes:

1. *The beak-quaking notes*—Harsh, unmusical, and of moderate pitch, used to express distrust and continued disapproval. During the delivery the mandibles are brought together three or four times in moderate succession. This is the ordinary scolding or distress cry of characteristic and uniform pitch, save that it is raised to a higher key when the speaker becomes vehement. The phrase varies from three to five notes, and is uttered in the following cadences: *kak-ako; ka ka, ka ka; ka ka kaka; kaka; kaka, ka kakak; kak-a kak-a-ka.*

2. *Kawk.*—A note of inquiry or mere communication; has many modifications and varies from a short trumpet note to the succeeding.

3. *Klook.*—A sepulchral note of uniform interest but uncertain meaning.

4. The trumpet notes, long or short, single or in prolonged succession, high-pitched, musical, and far-sounding. During delivery the head is thrust forward, the neck arched, and the throat and mandibles opened to their fullest capacity. These are pleasure notes and are used especially on social occasions, when many birds are about, *keer, keer, keer, keer.*

5. *A(n)k, a(n)k, a(n)k, a(n)k, a(n)k, a(n)k.*—Minor trumpet notes of regular length and succession, used in expostulation or social excitement; frequent and varied.

6. *Klook, klook, klook.*—In quality a combination of *kawk* and the trumpet tones, uttered deliberately and without much show of energy. Used chiefly in domestic conversation of uncertain import.

7. *Oree-eh, oree-eh, oree-eh, an an an.*—An expression of greeting as when uttered by a sitting bird welcoming one about to alight. The notes of the first series are trumpet tones, in which the second syllable of each member is raised to a higher pitch, while the voice is dropped again on the third. The second series is lower and more trivial, but still enthusiastic, as though congratulatory to the guest arrived.

8. *Ko.*—Shouted once, or thrice repeated, in quelling a clamor. "Hist! Hist! You're making too much noise; he's watching us."

9. *Arahh.*—A slow and mournful trumpeting, usually uttered awing, to express anxiety or grief, as at the loss of a chick.

10. *Oo anh, oo anh.*—Repeated indefinitely. Notes of coaxing and endearment usually addressed to children, but occasionally to wedded mates. The cooing of doves does not express so much adulation or idolatrous devotion as the gull throws into these most domestic tones.

Winter.—When winter, with its snow and ice, drives the glaucous-winged gull from the northern portion of its breeding range, there is a general movement southward; but the migration is more in evidence along the California coast, where this species spends the winter in large numbers, frequenting the harbors in company with glaucous, herring, California, western, and short-billed gulls. It winters commonly as far north as the Aleutian Islands, where it can always find open water.

DISTRIBUTION.

Breeding range.—Coasts and islands of the North Pacific Ocean and Bering Sea, from St. Lawrence Island and the Pribilof Islands southward to southern Alaska, British Columbia, and Washington to Destruction Island; westward throughout the Aleutian and Commander Islands; northward to Kamchatka and northeastern Siberia (Providence Bay). Occurs rarely in summer in northern Bering Sea (St. Michael and Port Clarence), but probably does not breed there.

Breeding grounds protected in the following national reservations: In Alaska, Aleutian Islands, as Adak, Atka, Attu, Kiska, Tanaga, and Unalaska; Bogoslof; St. Lazaria; Forrester Island; in Washington, Flattery Rocks and Quillayute Needles, as Alexander Island, Carroll Islet, and Destruction Island.

Winter range.—From the Aleutian Islands, Kodiak, and southern Alaskan coast southward to lower California (San Geronimo and Guadalupe Islands), and from the Commander Islands to Japan (Hakodadi). Birds remains late at the Pribilof Islands, but probably rarely, if ever, stay throughout the entire winter.

Spring migration.—Northward along the coast. Late dates of departure: Lower California, San Geronimo Island, March 10 to 15, and Guadalupe Island, March 22; California, Santa Cruz Island, May 2, and Monterey, May 10.

Fall migration.—Southward along the coast. First arrivals reach California, Monterey, October 25 to 30.

Casual records.—Rare visitor to Hawaii (taken December 9, 1902). Rare straggler north of Bering Strait; taken in Kotzebue Sound May 11, 1899, on Wrangel Island April 3, 1916, and at Point Barrow September 19, 1882.

Egg dates.—Alaska, south of peninsula: Fifty records, June 3 to July 16; twenty-five records, June 20 to July 3. Washington: Nineteen records, May 29 to July 23; ten records, June 14 to 19. British Columbia: Sixteen records, June 14 to July 16; eight records, June 16 to 24.

LARUS KUMLIENI Brewster.

KUMLIEN'S GULL.

HABITS.

Very little is known about the distribution, much less about the habits, of this and the following species—the two gray-winged gulls—as both are very rare. Kumlien's gull was described by Brewster (1883*a*) from a specimen secured by Ludwig Kumlien in Cumberland Sound on June 14, 1878.

Nesting.—When Kumlien (1879) found this species breeding in Cumberland Sound in 1878 he supposed that it was identical with the glaucous-winged gull of the Pacific coast and so reported it. He then gave us the following brief account of its habits:

> They are quite common in the upper Cumberland waters, where they breed. Arrived with the opening of the water and soon began nesting. The nest was placed on the shelving rocks on high cliffs. Two pairs nested very near our harbor, but the ravens tore the nest down and destroyed the eggs. Only a single well-identified egg was secured. This gull is unknown to Governor Fencker on the Greenland coast. They remained about the harbor a great deal and were often observed making away with such scraps as the cook had thrown overboard; were shy and difficult to shoot. Full-grown young of this species were shot in the first days of September. These were even darker than the young of *L. argentatus*, the primaries and tail being very nearly black.

Since that time nothing further has been learned of its breeding habits, eggs, or young.

Eggs.—Several sets of eggs were collected by Mr. J. S. Warmbath on one of the Peary expeditions, which have since found their way into collections as eggs of Kumlien's gull. These eggs were taken in Ellesmere Land on June 15, 1900, and are probably eggs of a new species of gull, to be known as *Larus thayeri*. Probably the only authentic egg of *Larus kumlieni* in existence is the one referred to above as taken by Kumlien. This egg is now in the United States National Museum; it is a miserable specimen, too badly broken to measure accurately, and is tied together with thread. In shape it is practically elongate ovate. The ground color is "olive buff"; it is sparingly spotted over the entire surface with small spots of "bister," "sepia," several lighter shades of brown, and various shades of brownish drab. If a series of eggs were available for study they would probably show the usual variations which are found in nearly all gulls' eggs.

Plumages.—Dr. Jonathan Dwight (1906) has made a careful study of the plumages of this rare species and, based on the examination of 22 specimens, has given us the following conclusions:

> The natal down is unknown, as no chicks have as yet found their way into collections. The juvenal plumage may be described as follows:
>
> Above, drab-gray mottled with dull white and obscurely barred and mottled with darker gray; below, more solidly gray, paler about the head and throat. Flight feathers a brownish gray, darker than the body, the outer webs of the primaries darkest. Tail almost solidly drab-gray, the basal portion and the outer pair of rectrices sprinkled with dull white; the upper and under tail coverts similar in color, but with a good deal of blotching or barring. They might easily pass for specimens of *glaucescens* if it were not for the small bills and rather smaller dimensions. They are considerably darker (especially the primaries) than the darkest *leucopterus* I have seen, and the nearly solid gray of the tail is a feature not seen in *leucopterus*. Besides this, the barring and mottling is much coarser and darker. In one of the birds there is a faintly

indicated whitish subapical spot on the first primary, but similar spots may be found in other species of gulls, and it seems to be a variable character of little importance. These specimens are perhaps not in full juvenal plumage, for they are probably partly in first winter dress; and two of them, just beginning the prenuptial molt, having acquired a few gray nuptial feathers of the mantle; but it must be remembered that the differences between juvenal and first-winter plumages of the gulls are inappreciable. It is probable that the brown shade is due to fading and that earlier in the season these birds were grayer.

First winter plumage.—From what has just been said it has been made evident that this plumage differs in practically no respect from the juvenal. The post-juvenal molt is variable in the time of its occurrence, just as it is in all the gulls, and overlaps the prenuptial so as to be in many cases confused with it.

First nuptial plumage.—This plumage doubtless closely resembles the juvenal or the first winter, but birds may be expected to become whiter about the head and with a few gray feathers on the back.

Second winter plumage.—Like *leucopterus*, this species attains a considerable amount of adult plumage at this moult. The gray mantle, clouded white head and body, and white tail indicate a close approximation to the adult plumage; but the primaries and other feathers of the wings are usually drab and not very much paler than in first winter birds. Dark gray or mottled feathers may also be found on the wings or tail or on the body posteriorly. The bills are yellow, but often clouded and with the red spot lacking. The variation is considerable, just as in *glaucus* or *leucopterus* or *glaucescens*, but the darkness of flight feathers or tail, or both combined, is a character useful in separating *kumlieni* from the two species last mentioned. The tail feathers, like those of *glaucescens*, while largely white, may show gray patches, chiefly on the inner webs.

Second nuptial plumage.—The body plumage is renewed more or less at the second prenuptial moult, and I find evidence of this in several specimens.

Third winter plumage.—Just as in the other gulls, this species after the second post-nuptial moult assumes (except perhaps in a very few cases) the adult plumage.

Behavior.—It is fair to assume that the habits of Kumlien's gull probably do not differ materially from those of the other large gulls, for they are all very much alike in general behavior with the possible exception of the tyrannous great black-backed gull.

Winter.—Kumlien's gull wanders southward late in the fall and winter, probably regularly, though sparingly, as far south as southern New England and New York, where it is associated with herring gulls and other species, acting as savengers about our harbors.

DISTRIBUTION.

Breeding range.—Known to breed only in Cumberland Sound. Specimens taken in Ellesmere Land prove to be *thayeri*.

Winter range.—So far as known, the Gulf of St. Lawrence (Prince Edward Island) and Bay of Fundy (Grand Manan); southward rarely to Massachusetts (Plymouth and Boston), and New York (Long Island and Mohawk River).

Spring migration.—Long Island, Rockaway Beach, March 8; Maine, Portland, April 27.

Fall migration.—Gulf of Cumberland, September 27; Prince Edward Island, October 7; Bay of Fundy, November 1.

LARUS NELSONI Henshaw.

NELSON'S GULL.

HABITS.

This large gray-winged gull of the Pacific coast and Bering Sea is so rare that its status, as a species, is none too well established, though the four specimens which had been studied by Doctor Dwight (1906) led him to the conclusion that "*nelsoni* seems to have as good a claim for specific distinctness as does *kumlieni*, of which it appears to be a large edition." Nothing seems to be known about its breeding habits or its breeding range.

Plumages.—Doctor Dwight (1906) after examining the scanty material available, suggests the following, regarding the probable plumage changes of this rare species:

> The young bird has never been described, but inasmuch as *kumlieni* in juvenal plumage is scarcely to be distinguished from *glaucescens*, there is every reason for expecting the corresponding plumage of *nelsoni* to be practically the same. The birds, though, ought to be larger than *glaucescens*, and I have no doubt that very large specimens now labeled "*glaucescens*" in various collections will eventually prove to be *nelsoni*. Such a bird has been recorded in the British Museum Catalogue, but somehow I overlooked it when examining the collection. In the American Museum, however, I find two specimens (Nos. 26234 and 61536) so much larger than *glaucescens* usually is that I believe them to be *nelsoni*. The tarsi and feet are unusually large and massive and the bills very heavy. The bird in the Philadelphia Academy is completing an adult post-nuptial moult, but the other specimens throw very little light on the subject of moult in this species.

I have never recognized the bird in life and can not find anything in print regarding its habits, in which it probably closely resembles Kumlien's and the glaucous-winged gulls. Some day, when its breeding grounds are discovered, we may know more about it. I am inclined to think that it may prove to be identical with *Larus kumlieni*, or at best only subspecifically distinct from it. The fact that a young gull, possibly referable to *kumlieni*, has been taken on the coast of California adds weight to this theory, which may be established when more material has been collected.

DISTRIBUTION.

Range.—Three specimens taken in Alaska—St. Michael, June 20; near Bering Strait; and Point Barrow, September 5. One taken in Lower California, San Geronimo Island, March 18. One taken in

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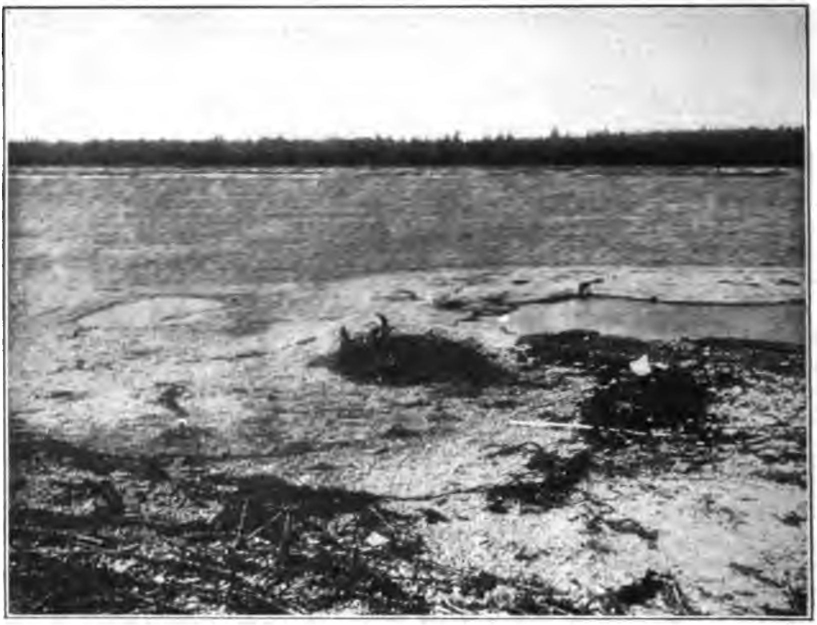
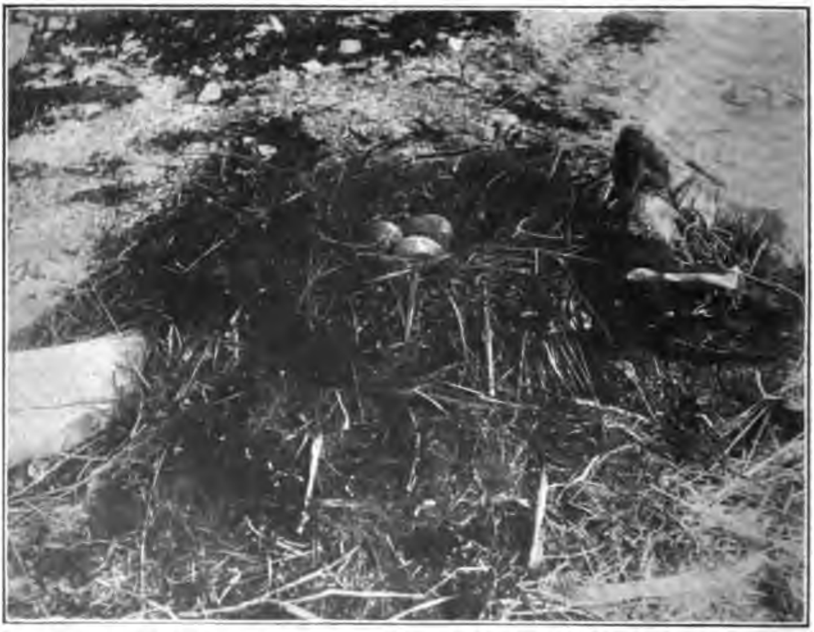


Labrador. A. C. Bent.



Labrador. A. C. Bent.

GREAT BLACK-BACKED GULL.

FOR DESCRIPTION SEE PAGE 330.

Hawaiian Islands, Hilo, March 13. One taken on Vancouver Island, December 20. Its ranges and migration are otherwise unknown.

LARUS MARINUS Linnaeus.

GREAT BLACK-BACKED GULL.

HABITS.

While cruising along the bleak and barren coasts of southern Labrador I learned to know and admire this magnificent gull, as we saw it sailing on its powerful wings high above the desolate crags and rocky islets of that forbidding shore, its chosen summer home. Its resemblance to the bald eagle was striking, as it soared aloft and wheeled in great circles, showing its broad black back and wings in sharp contrast with its snow-white head and tail, glistening in the sunlight. It surely seemed to be a king among the gulls, a merciless tyrant over its fellows, the largest and strongest of its tribe. No weaker gull dared to intrude upon its feudal domain; the islet it had chosen for its home was deserted and shunned by other less aggressive waterfowl, for no other nest was safe about the castle of this robber baron, only the eider duck being strong enough to defend its young.

Spring.—Early in May, when winter is breaking up on the south coast of Labrador, the loud defiant cries of the great black-backed gulls are heard as the birds return from their winter resorts to take possession of their summer homes. Mating and nest building begin soon after their arrival. They are not so gregarious here as other gulls. We found no large breeding colonies on this coast, seldom more than four or five pairs on an island, and often only one pair. They seem to prefer solitude and isolation, where each pair can hold undisputed sway over its own territory. We never found them breeding on the mainland, but always on the bare tops of islands, from which they could have a good outlook. They were never taken by surprise and always left the island long before we reached it, soaring high above us, screaming in protest. They were exceedingly shy and would never come within gunshot unless outwitted by strategy, which was no easy task. While walking along the shore at the base of a cliff a black-backed gull flew out over the cliff unexpectedly, and I dropped him with a charge of heavy shot, but this was the only specimen I was able to obtain.

Nesting.—The first nest we found was on a little low islet with sandy and rocky shores, over which a single pair of great black-backed gulls were soaring, as if interested. The nest was conspicuous enough when we landed, for it had been built over the base and about the roots of a dead tree which had been washed up on the beach—a large pile of coarse grasses, seaweeds, sods, and mosses neatly lined with fine grasses. It measured 52 inches across the pile, and the inner cavity, which was deeply hollowed, was 10 inches in diameter. It contained three fresh eggs on May 25, 1909. Another nest was found the next day, which also contained three fresh eggs, on the moss-covered rocks on the highest portion of a small island. It was a shallow nest of mosses, grasses, twigs, and rubbish, with a few feathers and a little seaweed. It measured 20 inches in outside and 10 inches in inside diameter, hollowed to a depth of about 2½ inches. There was only one pair of gulls on this island, but a pair of eiders were nesting in a hollow among some fallen dead trees. On some of the islands the nests were mere depressions in the turf 9 or 10 inches across, and the eggs were laid on the ground. The fresh green grass made a handsome border to these nests, but there was no lining of any sort, and not even a twig or bit of straw was used in the construction. Some of them had evidently been used for several seasons.

On the northeast coast of Labrador, in 1912, I found the great black-backed gull common and evenly distributed all along the coast, breeding in single pairs on low rocky islands, well inland in the deep bays and among the outer islands. They are locally known as "saddlers" or "saddle backs." They are intimately associated with the eider ducks, affording them some protection as sentinels to warn them of approaching dangers. There is almost always a pair of great black-backed gulls nesting on every island where the American eiders or northern eiders are breeding. The fishermen rob the ducks' nests persistently all through the summer, but do not disturb the gull's nests, for they believe that if the gulls are driven away the ducks will not return to breed again. Apparently the adult gulls do not rob the eider's nests, for they are too shy to do so while egg collectors are on the island, and at other times the eiders are able to defend their eggs; but I saw some evidence to indicate that the young gulls, when unable to fly but large enough to run about, do sometimes eat the eider eggs. While exploring a low rocky island in one of the bays, where several pairs of northern eiders and one pair of great black-backed gulls were breeding, on August 2, 1912, I noticed an eider's nest in which the eggs had been broken and eaten. One young gull was seen swimming away from the island and one long-legged youngster, about half grown, was running about over the smooth rocks so fast that we could hardly catch him. I suspected that he was responsible for the broken eggs. Probably the damage done in this way is more than offset by the benefits derived from such wary sentinels and such powerful defenders against the depredations of other gulls and ravens. Young gulls are considered to be very good eating and are often kept in confinement by the residents of Labrador and fattened for the table.

In Newfoundland the great black-backed gull breeds on the islands in fresh-water lakes. On June 23, 1912, I visited a small breeding colony of this species on an island in Sandy Lake, Newfoundland, where about seven pairs of gulls had already hatched their broods and where they had been known to breed regularly for many years. It was a small island, heavily wooded in the central higher portion with birches, poplars, alders, and thick underbrush, but with broad, stony beaches around its shores. The gulls' nests were scattered along the higher portions of the beaches among the loose rocks. All of the nests were empty and most of the young birds were so well hidden among the stones, under piles of driftwood, or in the woods that we found only two. I saw several downy young, only a few days old, swim away from the beach and out onto the rough waters of the lake, where their parents watched them anxiously and finally drove them back to the island after we had left. A pair of glaucous gulls and one or two pairs of herring gulls were flying about the island, but their nests were probably on some of the neighboring islands.

The southern limit of its breeding range seems to be in Nova Scotia, where there are several breeding colonies in the lakes of Kings County. Mr. Watson L. Bishop (1888) reported several sets taken on May 22 and May 25:

> These were collected on rocks and small islands in the Gaspereaux Lake, where quite a number of these birds breed every year. It is about 18 miles from salt water.

There is also said to be a colony of 50 or 100 black-backed gulls nesting on rocky islets in Methol Lake in this county. The largest colony seems to be the well-known colony in Lake George, on which Mr. Howard H. Cleaves has sent me the following interesting notes:

> In 1912 there were from 600 to 800 adult great black-backed gulls in the breeding colony at Lake George, Yarmouth County, Nova Scotia. At that time the birds were confined to two islands near the northern end of the lake, but Mr. Harrison F. Lewis observed that the colony had increased in 1913 and 1914 so that in the latter year the birds were occupying four or five islands. The writer and Mr. G. K. Noble spent the period from July 21 to 28, 1912, encamped on an island within a quarter of a mile of the gull islands, visiting the latter daily, when weather conditions permitted, for the purpose of photographing and otherwise studying the birds. The islands selected by the gulls were not large, each comprising probably between two and three acres. They were bordered with glacial bowlders of varying sizes, upon which the young and old habitually stood or squatted. The highest portions of the islands were not more than 8 or 10 feet above the level of the lake. The topsoil, evidently not deep, supported thick growths of weeds and bushes, chief among the latter being alders and raspberry. There were a few spruces, but these were small and scattering, and there were also several open areas of coarse turf. The lateness of the season at the time of our visit accounted for the finding of only one nest with eggs (three in number), but there were enough empty nests to justify the belief that all the adult birds present had bred, which would mean an aggregate of 300 or 400 nests.

The birds had used a diversity of sites, some being on rocky peninsulas, others on the turf back from the shore, and many among bowlders or beside stumps a short way from the water line. All seemed to have been situated with a view to affording the owners a clear outlook, it being noted that apparently no birds had selected locations beneath the canopy of the thicket or under the low, spreading branches of spruces.

Eggs.—The great black-backed gull lays usually three eggs, but sometimes only two. The ground color varies from "pale olive buff" to "wood brown," "buffy brown," or "Isabella color," with a tendency in some specimens toward "tawny olive" or "cinnamon." They are more or less heavily spotted or blotched with various shades of brown, varying from "Brussels brown" to "clove brown," and are often more or less spotted or clouded with pale lilac, drab, or lavender gray. The measurements of 59 eggs, in various collections, average 77.9 by 54.2 millimeters; the eggs showing the four extreme measure **86.5** by 54.5, 79 by **57.5**, **73** by 53, and 73.5 by **51** millimeters.

Young.—The period of incubation is said to be 26 days. Both sexes incubate and assist in the care of the young. The young remain in the nest for a day or two, but are soon able to crawl out and run about. They spend much of their time hiding in the grass, in crevices between stones, among the underbrush, or anywhere that they can find a little shelter, where they probably sleep most of the time; but when disturbed they can run with surprising swiftness. I have had to exert myself to the utmost to catch one of the larger young, whose long legs could carry it about as fast as I could run. They are fed by their parents on soft, semidigested food at first, but gradually they are trained to accept more solid food. Mr. Cleaves has sent me the following notes on the feeding process:

Young of all ages spent much energy in beseeching their parents for food, and the old birds often displayed a discouraging apathy toward their young at such times, even taking to flight or swimming away from the shore to escape the entreaties of their progeny. The older youngsters would sometimes swim after their parents in their eagerness for rations. In begging for a meal it was usual for a young gull to utter a whining cry and to run his bill along the neck or body of his parent. Not infrequently two or three young were thus besieging one old bird simultaneously.

In delivering food to her young the old gull first threw her head forward and downward (with a deliberation of movement which must have been painful to the waiting babies), then opened her spacious mouth and began a series of contortions with her neck muscles. The youngsters, being well aware by now of the imminent, centered attention on the flat stones in front of their mother, where the disgorged dainties presently appeared. Both parents were observed to feed the young. Immediately after delivering a meal the old birds sometimes stood by until the young were well underway with it—this so far as we could see, being for the purpose of keeping off neighbors, either young or old, who might be inclined to piracy. On one occasion an old bird chased into the water a half-grown youngster belonging to another pair, and, with her blows at the back of his head with her beak, might have murdered him had he not been able, by the use of both his wings and feet, to make the beach and scramble into the brush. A violent encounter lasting many seconds also took place between two adult birds, the striking of their beaks and the thrashing of their giant wings against the alders creating a commotion such as might do credit to a bull moose. It could not be determined whether the origin of these differences was a matter of food or trespass.

Plumages.—The downy young is mainly "pale olive gray," paler on the head and flanks and white on the central breast portion. The head is distinctly marked with well-defined spots, of various sizes and shapes, of "fuscous black"; the back is indistinctly spotted or variegated with "fuscous" and the wings are more heavily marked with an intermediate shade of "fuscous." The lower parts are unmarked. By the time that the young bird is half grown it is nearly fledged in its juvenal plumage, which appears first on the scapulars, wings, breast, and back, in about the order named. The dorsal feathers of this plumage are dusky, broadly tipped or margined with "avellaneous" or "vinaceous buff." This color pattern, which varies considerably in different feathers, is more pronounced in the scapulars and wing coverts than elsewhere. The color patterns in the different feathers vary from a solid dusky center, with broad buffy edges, to a herring-bone pattern, showing a dusky central streak with lateral processes, or to heavy transverse barring. The underparts are also variegated with dusky and "vinaceous buff" or "tilleul buff." The change from the juvenal to the first winter plumage is not well marked, as it is very gradual and is accomplished with a limited amount of molt. The buffy edgings on the dorsal surface fade and wear away during the winter until they become practically white before spring, when the back appears to be transversely barred with dusky and white. The head, which was heavily streaked with dusky in the fall, and the underparts also become much whiter before spring. In this first-year plumage the primaries are wholly black, with only the narrowest suggestion of white tips on the innermost; the secondaries and tertials are dusky and more or less broadly edged with buffy white; the greater coverts are somewhat variegated; and the lesser coverts are like the back. The tail is basally white, much mottled or variegated with "fuscous" or "fuscous black," with a broad subterminal band of "fuscous black." This band is broadest and the mottling is thickest on the central rectices, decreasing outwardly, so that the outer feather has only a large subterminal spot and a few dusky markings. The bill is wholly dark.

The second-year plumage shows only a slight advance toward maturity, and is mainly characterized by the mixture of several different types of feathers in the back, scapulars, and wing coverts. Some of these are wholly "slate color" or "blackish slate," as in the adult; others are basally so colored and terminally barred, spotted, or variegated; still other new feathers are reproductions of those seen in the first year plumage. There is great individual variation in the amount of "slate color" assumed during this year, but probably it increases as the season advances. The wings are not strikingly different from those of the first year. There are more conspicuous white tips on the tertials, secondaries, and inner primaries, and the coverts contain more "slate color." The underparts are largely or wholly white, increasingly so toward spring. The bill is lighter near the base and has a light tip.

The third-year plumage shows about the same stage of advance toward maturity as the second year in the herring gull. The mantle is now more than half "blackish slate"; the wing-coverts, both greater and lesser, are still mottled with dusky and white, but there are many adult feathers among the mottled ones; the secondaries and tertials are as in the adult; the primaries are black, tipped with white, and the outer primary now has a broad subterminal white space an inch and a half long. The tail is white, more or less variegated with dusky near the tip. The underparts are pure white, and so is the head, except for a few dusky streaks on the hind neck, which disappear before spring. The bill still shows traces of dusky.

At the next postnuptial molt, when a little over 3 years old, some birds probably assume the adult plumage, with the pure white tail, the complete dark mantle and the broad white tips of the primaries, which in the first primary measures 2½ inches. But probably a large majority of the birds still retain traces of immaturity in the primaries and the tail, which do not reach their full perfection until a year later; and apparently the white in the primaries increases a little at each succeeding molt until the maximum is reached.

Both adults and young have a complete postnuptial molt in August and September, and an incomplete prenuptial molt during the winter and early spring. The adult winter plumage differs from the nuptial only in having a few faint, narrow streaks of dusky on the hind neck, which are more conspicuous in the younger birds and less so in the older ones.

Food.—The great black-backed gull is a voracious feeder, omnivorous, and not at all fastidious. On or about its breeding grounds it feeds largely on the eggs of other birds, particularly sea birds, when it can find them unprotected, or upon the small young of such birds as are unable to defend them. Mr. M. A. Frazar (1887) describes its method of capturing young eiders as follows:

> Two or three gulls will hover over a brood in the water, which, of course, confuses the mother duck and scatters the brood in all directions. Then, by following the ducklings after each dive, they would soon tire them out, and a skillfully directed blow at the base of the skull, which seldom missed its

> aim, would in an instant finish the business, and, before the unhappy duck would know which way to turn, its brood would be one less. On several occasions I have seen the mother duck drawn several feet in the air by clinging to the gull as it dove for its prey, and several times I have seen a venturesome "black-back" get knocked over with a charge of shot when he happened to get too interested in his pursuit and allow of my too close approach.

He writes in the same paper that some of these gulls partially devoured some cormorants which he had shot and allowed to drift on the water for a short time. It feeds largely on fish, but probably seldom succeeds in catching them itself. It does not object to carrion, and will gorge itself on the carcass of a dead whale or pick up anything that it can find in the way of animal food along the shore. While wintering on our coasts it does its part as a scavenger, feeding on floating garbage with other gulls.

Mr. Cleaves contributes the following notes on its feeding habits:

> From remains discovered on the ground it was evident that the food of the birds consisted exclusively of fish and allied sea food. The greater portion of a large squid was once found where it had been abandoned, evidently by a fleeing youngster; and on another occasion we discovered a 10-inch mackerel that had been very little affected by the digestive juices of the old gull that had delivered it to her young. Lesser remains of fish were frequently found, and occasionally we came to bones where it would seem they had been disgorged in the shape of pellets. None of the food was secured in the fresh-water lake, but was obtained from the ocean, which lay more than 5 miles distant to the west. From early morning until late in the evening the old gulls were seen flying either toward the ocean or returning from it, their course being always the same. The birds traveled in companies of twos or threes, and while passing over the land barrier always sought an altitude which insured safety from any possible gunshot.

Behavior.—The soaring flight of the great black-backed gull is majestic and grand in the extreme. It has been well likened to the flight of an eagle, for the resemblance to the king of birds is certainly striking, as it floats in great circles high above its rocky home, the monarch of its tribe. When traveling its flight is slow and heavy, as might be expected in the largest of the gulls, but it is always strong, dignified, and protracted. Macgillivray (1852) writes:

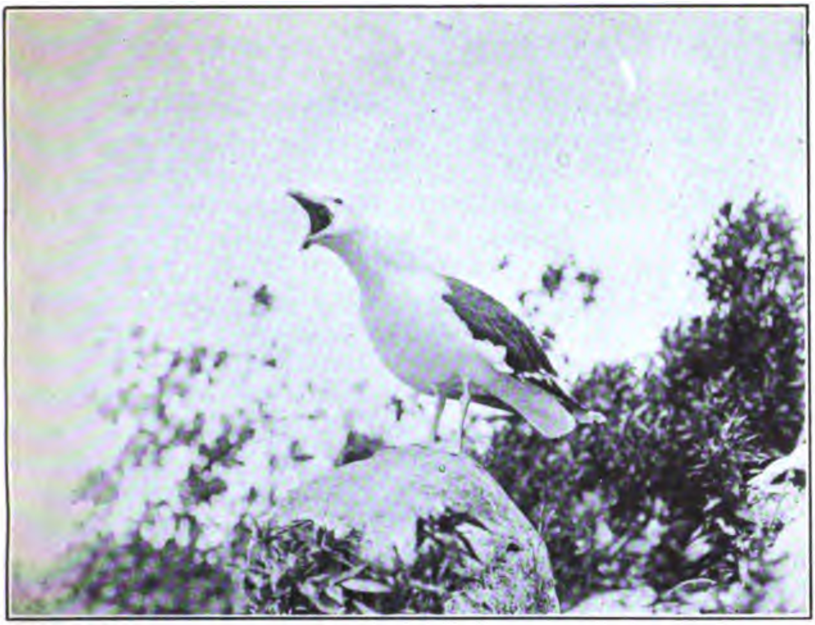
> Its flight is strong, ordinarily sedate, less wavering and buoyant than that of smaller species, but graceful, effective, and even majestic. There, running a few steps and flapping its long wings, it springs into the air, wheels to either side, ascends, and on outspread and beautifully curved pinions hies away to some distant place. In advancing against a strong breeze it sometimes proceeds straight forward, then shoots away in an oblique direction, now descends in a long curve so as almost to touch the water, then mounts on high. When it wheels about and sweeps down the wind its progress is extremly rapid. It walks with ease, using short steps, runs with considerable speed, and, like the other gulls, pats the sands or mud on the edge of the water with its feet. It generally rests standing on one foot, with its head drawn in; but in a dry place it often reposes by laying itself down.

Although usually silent elsewhere, it is a very noisy bird on its breeding grounds, indulging in a variety of loud, harsh cries or raven-like croaks. It has a long drawn-out scream—*keeaaw*—on a lower key than that of the herring gull. It also has a short, more quickly uttered note—*kow*, *kow*, *kow*—very much like the other gulls; also a high pitched *ki ki* and a hoarse laughing *ha*, *ha*, *ha*. Its courtship note is softer and more prolonged, sounding at times like *kowaat*, but varied and modulated in a most human manner. Mr. Cleaves describes some of the vocal performances as follows:

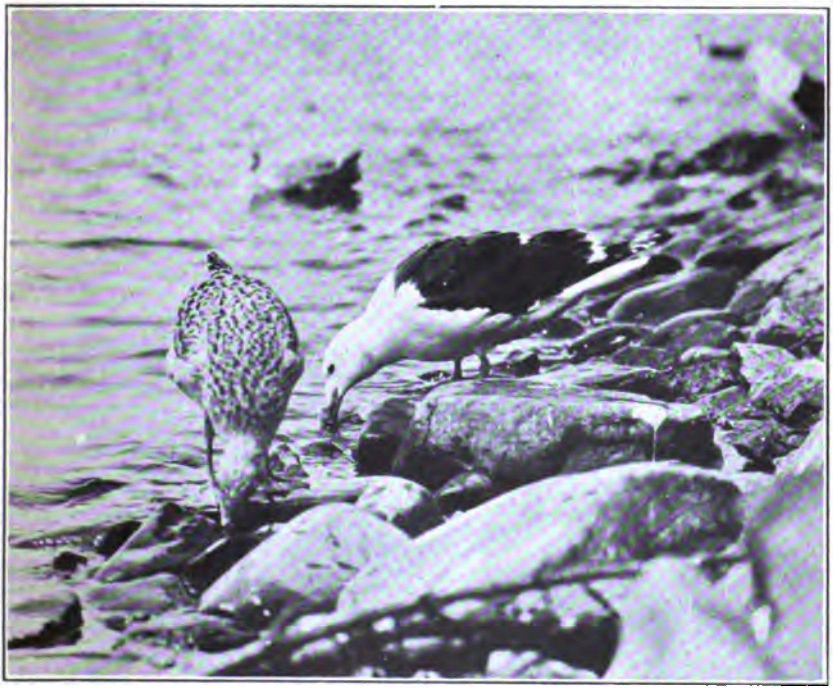
> There were few moments of the day or night when absolute silence prevailed in the colony. The sounds produced by the birds were varied, both in form and in volume, and ranging from the baby whine of the downy young to the great bellow or trumpet of a giant adult black-back standing above the lake on a 6-foot bowlder. The calls intermediate between these two extremes were mostly variations of groans or kindred sounds, some of which were soft and to be heard only at short range. There were two cries, given perhaps with greater frequency than all others, which the writer can now recall with most distinctness. One was the mellow "kuk-kuk-kuk," uttered when the birds were disturbed and far aloft over the islands; the other, the inspiring trumpeting bellow, emitted when the gulls were unmolested, and usually when standing on some prominence or on the open shore. Each syllable of the latter cry sounded like "oo" in "loon," given slowly and with comparative softness at first, but repeated slightly more rapidly as the call proceeded and the syllables gaining volume until, at the end, when the sound had been uttered 8 to 14 times, the noise was tremendous at a range of only a few feet. The uproar caused by a chorus of 50 trumpeting gulls could no doubt be distinctly heard over the lake on an otherwise still morning at a range of a mile or more. In producing this bellowing call a bird usually began on the introductory notes with his head lowered, raising it as the call advanced, until, at the finish, his open bill pointed toward the zenith and his neck was inflated from the force of his "challenge."

Mr. Cleaves relates in his notes the following interesting incident:

> One pair of old birds, who apparently had but a single chick of probably two weeks, engaged in a curious performance only 8 feet from the wall of the blind. Amid rumbling sounds and groanings from the parents and whining from the baby one of the old birds picked from the beach a dried fern leaf and waded slowly and with apparent gravity into the lake with it until he was belly deep in the water. He then stopped and thrust his bill and its contents beneath the surface, moving his head rather vigorously from side to side as he did so. The female (?) followed a few paces behind with empty beak, and when she was a little way from the shore she submerged her entire head, holding it below for two or three seconds. After withdrawing it she took a step or two forward (following the first bird) and then immersed her head again. Throughout the entire ceremony the youngster whined, apparently for food, and waded as far in the wake of his elders as he could, with comfort, in the choppy waves. The bird carrying the fern then came slowly back to shore where his burden was dropped without further formality. Some minutes later, however, the same bird picked up a cast primary from the beach and reenacted almost the exact ceremony through which he had gone with the dead fern, and the other members of



Lake George, Nova Scotia. H. H. Cleaves.



Lake George, Nova Scotia. H. H. Cleaves.

GREAT BLACK-BACKED GULL.

FOR DESCRIPTION SEE PAGE 330.

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the family repeated their parts of the act also. Whether all of this was mere play or whether it possessed a greater significance it would no doubt be difficult to determine.

Winter.—About the middle of August, or as soon as the young are able to fly and care for themselves, these gulls leave their breeding grounds and wander about or start to migrate southward. They sometimes appear on the Massachusetts coast in August, though not regularly until September, where they are more or less common all winter until the second or third week in April. Dr. Charles W. Townsend (1905) records them as common on the coast of Essex County, Massachusetts, from July 17 to May 1, and says, "as early as July 17, 1904, I found seven adults in a flock of herring gulls on Ipswich Beach," though these may have been summer stragglers and not migrants from their breeding grounds farther north. Their normal winter range extends from southern Greenland to Delaware, with straggling records farther south. While wintering on our coasts they associate freely with the herring gulls, with which they seem to be on good terms, feeding with them on what refuse they can pick up in our harbors or along the shores. They are practically silent and not nearly so tyrannical as on their breeding grounds, though they may occasionally be seen chasing the other gulls and robbing them of their food. Adult birds can, of course, be easily recognized and the superior size of the immature birds is distinctive. While roosting on a sand bar or on floating ice a black-backed gull always looms up large in a flock of herring gulls. They are exceedingly shy at this season, and it is useless to attempt to approach them in an open situation.

DISTRIBUTION.

Breeding range.—Coasts and islands of northeastern North America and northern Europe. In the Western Hemisphere, from North Devon Island and central western Greenland (Disco) southward, along both coasts of Labrador to eastern Quebec (Godbout), Anticosti Island, Newfoundland (Sandy Lake), Nova Scotia (Pictou, Halifax, and Kentville) and Bay of Fundy (Isle au Haute). In the Eastern Hemisphere, Iceland, Shetland, and Faroe Islands, Scotland, and northern Europe east to eastern Russia (Petchora River), and south to about 50° N.

Winter range.—Regularly on the coast of the United States from Maine to New Jersey. More rarely north to southern Greenland and south to northern Florida (St. Augustine) and Bermuda. Occasionally south to Ohio (Columbus) and west to Michigan (Detroit) on the Great Lakes. In Europe from Great Britain south to the Azores and Canary Islands, the Mediterranean, and the Black Sea.

Spring migration.—Early dates of arrival: Newfoundland, St. Johns, March 1; Labrador, Romaine, March 26, and Rigolet, April 9. Late dates of departure: New York, Long Island, May 13; Massachusetts, Boston, May 25, and Woods Hole, June 10. Nonbreeding birds linger on the coasts of New England late into or all through the summer.

Fall migration.—Early dates of arrival, excluding summer stragglers: Massachusetts, Woods Hole, September 24 (average October 8); Long Island, Orient, September 12 (average October 5). Late dates of departures: Greenland, Gothaab, September 3; eastern Labrador, November 2; Prince Edward Island, November 12; Nova Scotia, Pictou, December 13.

Casual records.—Accidental in Nebraska (Missouri River, May, 1871), Kerguelen Island (June 5, 1840), and Japan (Hakodadi).

Egg dates.—Quebec, Labrador: Twenty records, May 25 to June 28; ten records, June 5 to 15. Nova Scotia: Fifteen records, May 15 to June 13; eight records, May 22 to 27. Great Britain: Eleven records, April 28 to July 20; six records, May 20 to June 1. Iceland: Three records, May 18 and 28, and June 6.

LARUS SCHISTISAGUS Stejneger.

SLATY-BACKED GULL.

HABITS.

Dr. Leonhard Stejneger (1885) has demonstrated, by an exhaustive treatise on the subject, that this is a well-marked species, although one can not read his remarks without realizing how much confusion has arisen over the nomenclature and relationships of the Laridae. In both size and color it is intermediate between the great black-backed gull and the western gull; but its best and most constant character is the color pattern of the primaries, which Doctor Stejneger has well described and illustrated. It is an Asiatic species, with its center of abundance in northeastern Siberia, which has established a slight foothold on some of the islands of Bering Sea and in northern Alaska, chiefly as a straggler. It may eventually become better established in Alaska, as several other Asiatic species have done.

Spring.—Doctor Stejneger (1885) first saw it on Bering Island, in the Commander Islands, but afterwards found it common near Petropaulski, Kamchatka. Mr. N. G. Buxton's notes, published by Dr.

J. A. Allen (1905), give the best life history of the species in that region. He writes:

> This is the most conspicuous and one of the most abundant birds along the Okhotsk Sea. From the time of its arrival until it departs there is scarcely a time when one can not either hear or see one or more of these birds. The first arrivals are usually reported about the 20th of April, and from that time on they increase in numbers daily until May 1, when they have nearly all arrived. From the time of their arrival until the nesting season begins they make daily excursions up the rivers in the morning and return to their roosting places along the seacoast in the evening. They go up the Gichiga River at this time as far as Christova, 30 miles above its mouth. Also at this time many may be seen soaring in large circles high over the tundra and marsh above the mouth of the river, when they utter a cry very similar to that of the red-tailed hawk during the breeding season. None of the dark phase are seen among the earlier arrivals, but by the 15th of May they begin to appear, and increase in numbers until they have all arrived, although at no time during the spring and early summer do they form any considerable per cent of the thousands that one sees. Before the ice goes out of the head of the bay and river, their food supply is limited to the few dead salmon which the melting snow exposes on the gravel bars along the river beds and the mussels they pick from the rocks along the seacoast at low tide.
>
> *Nesting.*—By the first of June all of the breeders have repaired to the rugged seacoast and rocky islets lying off it, below the mouth of the river, to breed. Only the roughest and most inaccessible places are chosen for nesting sites, generally at the headlands, where sections of the solid rocks have been partly or wholly separated from the mainland. The nests, which are loose, bulky structures, composed of grass and with but a slight depression in the center, are placed on ledges and the tops of rocks. Three eggs constitute a set, and they show the usual large variation in color and size found in the eggs of other species of *Larus*. The height of the nesting season is reached about June 10, when the koraks visit their rookeries and obtain large numbers of their eggs by being lowered down the cliffs with sealskin lines. Many more breeders spend the summer on the bars and along the marsh near the mouth of the river, and on the gravel bars along its bed.

Rev. W. F. Henninger (1910) refers to three sets of eggs of the slaty-backed gull, containing three, two, and one eggs, respectively, that were "taken on the coast of Siberia, near the Bering Strait, on June 4, 1905. The nest was a mere depression or hollow in some moss." There are two sets, of three eggs each, in Col. John E. Thayer's collection, taken by Capt. H. H. Bodfish in Harrowby Bay, on the Arctic coast of northwestern Canada, June 11, 1901. The nests are described as made of grass, roots, and mud and lined with dry grass; they were placed on a point making into the bay. The parent birds were collected and the skins were identified by Mr. Robert Ridgway and Dr. A. K. Fisher. These are probably authentic sets, though they were taken outside of the previously known breeding range of the species.

Eggs.—These two sets might easily be matched with eggs of some of the commoner species of *Larus*. The shape is practically ovate and the ground color is "Isabella color." They are more or less evenly covered with small spots of "clove brown," "blackish brown," "sepia," and "bister," as well as several shades of "brownish drab."

Two eggs in the writer's collection, from the Asiatic coast, show other extremes of coloration. The darker one has a ground color of "Saccardo's umber" and is spotted with "blackish brown" and "brownish drab;" the lighter one has a "deep olive-buff" ground color and is spotted with "snuff brown," "bister," and several shades of "brownish drab," some very light and some very dark shades. The measurements of 34 eggs, in various collections, average 74 by 51.5 millimeters; the eggs showing the four extremes measure **81** by 52, 77 by **54, 67.1** by 50 and 72 by **48** millimeters.

Plumages.—I have never seen the downy young of this species, nor can I find any description of it in print. The sequence of molts and plumages, so far as can be learned from the limited amount of material available for study, is practically the same as in the great black-backed gull. Young birds during the first fall and winter are darker than those of the commoner species, particularly on the underparts, which are nearly uniform dusky.

Behavior.—For the remainder of the life history of this little-known species I must again quote from Mr. Buxton's notes, as follows:

> After the nesting season is over, about the 1st of August, the breeders and young of the year join the nonbreeders and they all spend the rest of the season in flying up and down the river, collecting in large flocks along the water front, and gorging themselves on the worn-out salmon that they find there. At this time they begin to fly up the river at 2 or 3 o'clock in the morning, continuing to fly until the middle of the forenoon, and then begin the return flight at 5 p. m., and continue to fly until long after dark, which does not occur at that time until 10 or 11 p. m. They are so abundant that on these flights there is one continuous long, loose flock of them without any considerable break or intermission. The height of the return flight is from 6 to 8 p. m. When the wind is strong they fly high, but when it is calm they fly low and are easily attracted. When one is killed on the wing, or a decoy is thrown into the air, all the gulls in the vicinity will immediately "land about" and circle once or twice over the dead bird or decoy, changing their usual guttural cackle to hoarse "squeals" of alarm before proceeding on their way. I have often seen them attempt to take a fish from the mouth of a seal when it arose to the surface and which the gull had been watching catch the fish. By the last of August one dark or young one is seen to every four or five adult or white ones, and later the proportion of the dark ones is much higher, as the adults begin to leave first. By the 1st of October the migration is well advanced, and decreases daily until by the 15th of October few remain, although the last of them do not leave until the last week of the month. They are the last of the migrants to leave in the fall.

DISTRIBUTION.

Breeding range.—Asiatic coasts of North Pacific and Bering Sea; from northern Japan (Yezzo), Kurile Islands, Kamchatka, and shores of Sea of Okhotsk north to Gulf of Anadyr and vicinity of Bering Straits. The breeding record from Harrowby Bay, Arctic coast of Canada, appears to be authentic, although far outside of the known breeding range.

Winter range.—So far as known, only from Japan to the Kurile Islands.

Spring migration.—Migrants recorded at Commander Islands, Bering Island, April 20 to May 5; Copper Island, June 13; Sakhalin Island, May 11. They arrive on their breeding grounds in the Anadyr district by April 20.

Fall migration.—During migration birds occur along the Alaskan coast, Diomede Islands, September; off Nome, August 31 to September 8; St. Michael, September 9; Port Clarence, Sakhalin Island, late September. The last birds leave the Anadyr district late in October.

Casual records.—Stragglers have been recorded at Herald Island (Ridgway), Unalaska (Chernofsky Bay, October 1, 1880), and taken in Mackenzie (Franklin Bay, June 9, 1901).

Egg dates.—Japan: Eight records, May 23 to June 18; four records, May 29 to June 15.

LARUS OCCIDENTALIS Audubon.

WESTERN GULL.

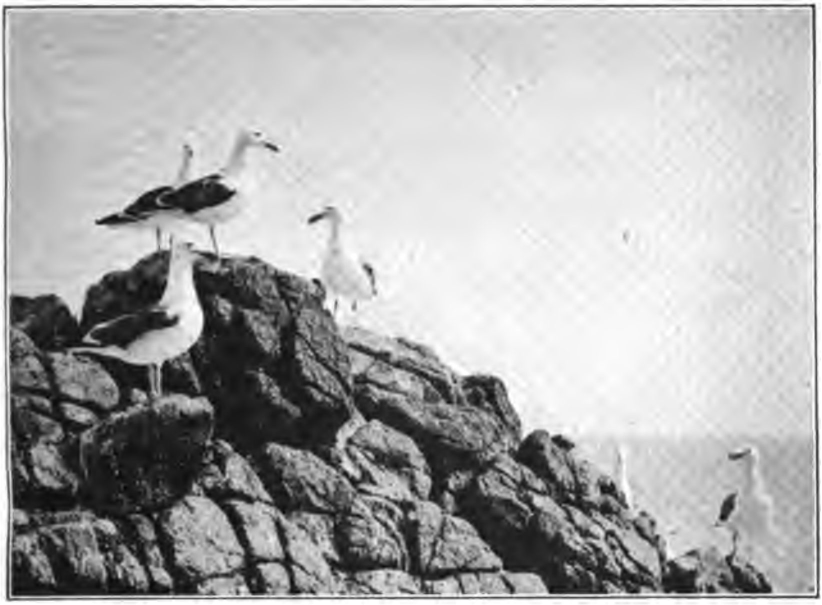
HABITS.

Along the numerous beaches of the California coast the dark-mantled western gull is the most conspicuous and the most universally abundant sea bird throughout the whole year, everywhere much in evidence and everywhere tame and familiar—a welcome visitor as a useful scavenger and a pretty feature in the seashore scenery. The immaculate purity of its snow-white plumage is kept spotlessly clean, in spite of its untidy feeding habits. As we see these beautiful black and white birds sailing along the ocean cliffs they seem to reflect the clear freshness of the beach and sea and sky; and as we see them walking daintily on their long legs over the clean sand it seems incongruous to associate them with the struggling screaming mob of hungry birds that we have just seen fighting for and gorging themselves on the refuse from the sewers or the garbage dumps.

During my stay at Redondo Beach, in June, I spent considerable time watching these interesting and familiar birds. There were always plenty of them to be seen flying along the beach or resting in groups on the flat, smooth sand, adults and young in several different stages of plumage, and generally a few Heermann's gulls were mingled with them. It was in the height of the breeding season and I wondered whether the adults had nests on the islands off the coast or were birds that were not breeding that season. Some of them were standing on one leg, with bills tucked under their scapulars, sound asleep; but more of them were resting on their breasts. One old male seemed to be the boss of the beach and acted as a disturber of the peace by walking around, driving off the Heermann's gulls and waking up all the gulls that were asleep, making them move on, as a policeman does with loafers on a sidewalk. One was seen playing with a feather, picking it up, letting it blow away and running after it again, as if he enjoyed the fun. Occasionally one would walk down to the surf line to pick up a morsel of food, to drink or to bathe, and return to dry land to preen its feathers. They were tamer than any large gulls I had ever seen. I had no difficulty in shooting them, picking out the exact plumage that I wanted to complete my series. As soon as one was shot a flock gathered about me, hovering over my head with intimate curiosity; and while walking along the beach with dead gulls in my hand there were always several following me, close at hand. Even about the much-frequented wharves they were very unsuspicious, standing on the posts and railings within 10 or 15 feet of numerous human beings, in whom they justly had perfect confidence, for they are never molested. About the fish houses, where men were cleaning fish, they were particularly familiar, standing in rows along the roofs, or on the stringers waiting for the offal to be thrown into the water. No one seemed to notice them at all, but to me it was a novel and interesting sight.

There was a time when persistent egging on the Farallones was reducing the population of western gulls, but since that has been stopped they are increasing again. They are probably not much disturbed on their breeding grounds and are generally protected. Hence they have become familiar and useful birds on the coast, but they are more of a nuisance than ever on the islands where they do so much damage to other species.

Spring.—As this gull is practically a resident throughout its range, it has no well-marked migration. The spring migration merely amounts to a concentration on its breeding grounds or a withdrawal, and only a partial one at that, from its somewhat wider winter range. In the southern portion of its breeding range in Lower California this occurs early in March, in southern California in April, and correspondingly later farther north. It retreats in the spring from the Puget Sound region to the northern limit of its



Farallon Islands. O. J. Heinemann.

Humboldt County, California. W. L. Dawson.

WESTERN GULL.

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breeding range in the bird reservations on the coast of Washington, where it mingles with the glaucous-winged gull at the southern limit of the latter's breeding range.

Nesting.—Dawson (1909) says that the northernmost colony of unmixed *occidentalis* on the Washington coast is on Willoughby Rock, off Cape Elizabeth; "but scattered pairs occur, along with glaucous wings, as far up as Carroll Islet." He says of its nesting habits:

> Nesting is undertaken in May, and by the 20th of that month, or by June 10 at the latest, the complement of three eggs is laid. Nests are composed almost exclusively of dried grasses plucked by the birds, roots and all; and these become quite substantial structures if the grass is convenient. Ledges, crannies, grassy hill sides, and the exposed summits of the rocks are alike utilized for nesting sites; while occasionally a bird ventures down so close to the tide line as to lose her eggs in time of storm. Chicks are brought off by the third week in June or by the 1st of July, according to season, if unmolested. If the first set is removed, however, the birds will prepare a second, consisting almost invariably of two eggs, and these are deposited as likely as not in the same nest as the former set. Deposition occurs at intervals of two or three days.

On the Three Arch Rocks, Oregon, Mr. W. L. Finley (1905) describes the nesting of this species as follows:

> The gull picks out a comfortable spot and builds a respectable nest, and that is about the only creditable thing he does on the rock. The grass-covered roof of the island is his favorite nesting place, although many select the niches in the bare rock on the face of the cliff. The gull's eggs lie right out in the open and never seem to be bothered by other birds; they themselves do not ravage the homes of their own kindred. The eggs are of dull earthy and chocolate-brown tints, with darker blotches, matching their surroundings so perfectly that we had to be constantly on the lookout to keep from stepping on them. When the eggs were hatched we found the nestlings were protected by equally deceptive clothes of a mottled gray color.

The best known breeding grounds of the species are on the Farallon Islands, which have been well described by several writers. According to Mr. W. Otto Emerson, who sent some original notes on the subject to Major Bendire, the gulls begin building or repairing their old nests about May 1, and the nesting season is prolonged through May and June. The nests are built wholly of dry Farallon weed, *Baeria maritima*, the old nests being used year after year. After being robbed the birds soon begin laying again, and he noted, by watching a certain nest, that an egg was laid every other day.

Mr. Milton S. Ray (1904) has given us the following good account of the Farallon colonies:

> While this bird builds in colonies, so to speak, they are not like those of the cormorant or murre. There is always fighting room between the nests, and only the aggregations near Shell Beach, Indian Head, and at Guano Slope on West End, and about Tower Point on East End, could well deserve this term.

> Besides these places we found them breeding in scattered congregations all along the rocky terrace west of the Jordan, from the shore to the highest points. On the east, in addition to the rookery at Tower Point, we observed a dozen isolated nests at Bull Head Point, near Arch Rock, and about half that number right at the Weather Bureau observatory, where, rewarded for their confidence in man, they brooded unmolested. The great mass of driftwood, thrown up by winter storms, was a favorite spot in the Shell Beach rookery. We did not, however, observe any of these birds nesting off the main island.
>
> While they are somewhat wary, many allowed us to come quite close before rising from their nests. The latter are placed in natural basinlike hollows among the rocks, by which they are partially sheltered, although some were in the most open and windy situations. The nest is a bulky structure, composed of various dry island weeds and grasses, and has about as much claim to ingenuity as those of most sea birds. They vary little in size, averaging 18 inches across, the cavity being 8 inches by 4 deep. About many of them I noticed small heaps of ejected fishbones.

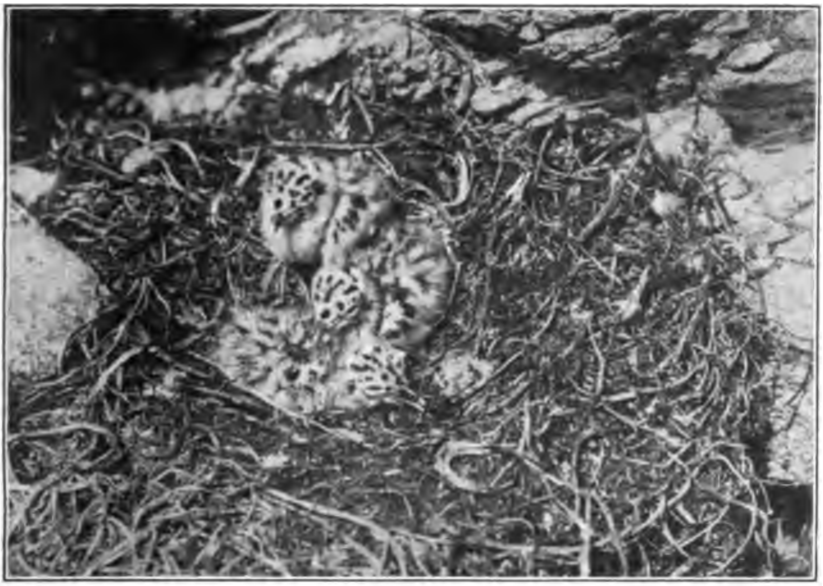
Mr. Brewster (1902) says of the nesting habits of this species in the Cape Region of Lower California:

> Mr. Frazar found a breeding colony of about 25 pairs on a small rocky island a little to the westward of Carmen Island. Most of the nests were only just begun, and but two contained eggs, one set, however, comprising the full complement of three. This was on March 18—a date about two months earlier than that at which the first eggs are usually taken on the Farallon Islands near San Francisco. The next day another breeding ground was discovered on the northern end of the island of Montserrat. Here some 50 pairs had congregated. Few of their nests were finished and only eight contained eggs, the number in each set varying from one to three. At both of the places just mentioned the nests, which were made of seaweed, were built at the foot of the cliffs, just above high-water mark, and often in nooks or crevices.

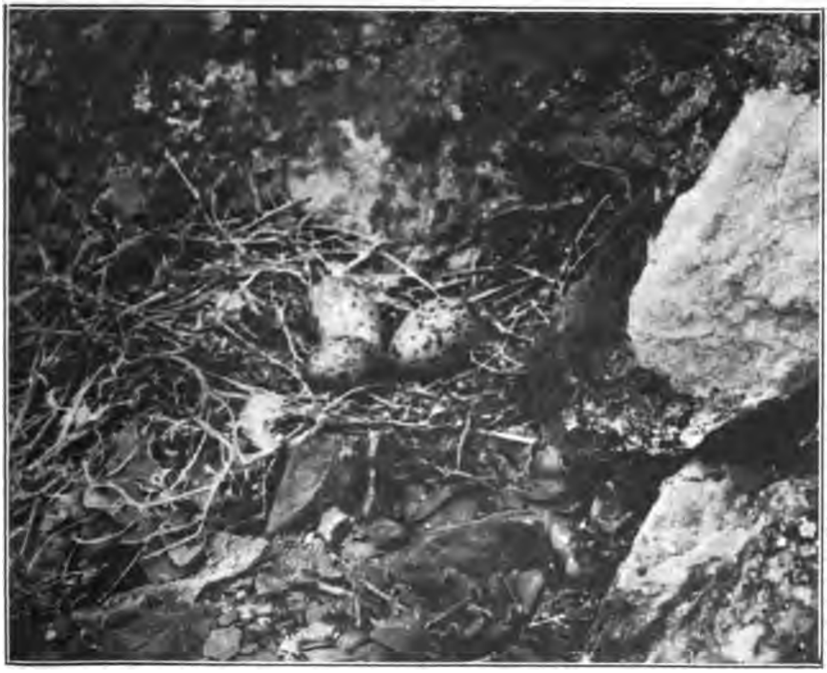
Although the nest may be frequently robbed and several sets of eggs may be laid, only one brood of young is raised in a season. The normal set consists of three eggs, though two eggs often constitute a full set in the later layings, and sometimes a single egg is incubated. Sets of four eggs are rare.

Eggs.—The eggs of the western gull can not be distinguished with certainty from those of other gulls of similar size, and they are subject to the usual variations. The ground color is "buffy brown," "tawny olive," "cinnamon buff," "deep olive buff," or "pale olive buff." They are usually heavily spotted, blotched, or scrawled, more or less evenly, with "clove brown," "bister," "burnt umber," and various lighter shades of brown, as well as various shades of "Quaker drab" and "mouse gray." The measurements of 70 eggs, in various collections, average 72.4 by 50.4 millimeters; the eggs showing the four extremes measure 78 by 47, 73 by 53, 67.5 by 48 and 78 by 47 millimeters.

Young.—Mr. Emerson gives the period of incubation as 24 days. He says that both sexes take turns at the duties of incubation, but there are no set times for relieving each other. The bird which is



Farallon Islands. O. J. Heinemann.



Los Coronados Islands, California. D. R. Dickey.

WESTERN GULL.

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off duty usually stands near the nest, on guard, slipping onto the nest when the sitting bird leaves. The young remain in the nest for a few days and are brooded by their parents, who are very bold and devoted in their defense. The young gulls soon learn to run about, becoming very lively, and are taught by their parents to become experts in the art of hiding. Mr. Finley (1905) says:

> They teach their young to keep hidden and to lie close. I have seen more than one gull impress this upon her children. One day I was walking along a ledge and came abruptly to a place where I could look down the top slope. Below me a few yards I saw two half-grown gulls; one crouched beside a rock; but the other started to run down the ridge He hadn't gone 2 yards before the mother dove at him with a blow that knocked him rolling. He got up dazed and struck off in a new direction, but she swooped again and rapped him on the head till he seemed glad enough to crawl in under the nearest weed.
>
> Occasionally we found the gulls very pugnacious. There was one mother that had a nest of three young birds on a narrow ledge, and every time the photographer approached her nest she would dart at him. She swooped at his head with a loud bark, something like a watchdog; at 6 or 8 feet distant she dropped her legs and took a sharp clip with her feet. Twice she knocked the hat from the intruder's head.

Mr. Dawson (1909) visited a colony of this species in July and found that:

> Young birds, from infants to those half grown, were in hiding everywhere. The danger sign had, of course, been passed around, and not a youngster on the island but froze in his tracks, no matter where he happened to be. It was pathetic to find, as I did now and then, babes soaking heroically in the filthy green pools left in hollows of the rocks by ancient rains rather than attract attention by scrambling out. One youngster had evidently been nibbling playfully at a bit of driftwood cast high up, for I found him with the stick between his mandibles as motionless as a Pompeian mummy.

So bold and solicitous were the anxious mothers in the defense of their young that he was struck three times upon the head, always from behind, by vicious beaks while engaged in gathering up babies for a picture.

The young gulls are fed at first on semidigested foods, but their parents soon begin to feed them on small fish and other animal food. They become more omnivorous in their diet as they grow older, and are very voracious feeders. Their parents keep watchful guard over them until they are able to fly and will not let them attempt this hazardous feat until the proper time comes. Mr. A. B. Howell has noted that "if when full grown but still timid on their wings, they are thrown into the air, they will essay unsteady flight and are sure to be pounced upon by their elders, who, for some reason or other, knock the youngsters heels over head as long as they remain in the air"—a decided hint that the time for flight has not arrived.

Plumages.—The downy young is "drab gray" above variegated with "avellaneous" or other shades of buff. Some individuals are grayer and others are brighter buff in color. The lower parts are lighter colored, paling to "tilleul buff" on the center of the breast; sometimes the breast is bright, clear, "avellaneous" buff in newly hatched young, the colors fading as the youngster grows. The back is heavily spotted with "fuscous black," and the head and throat with pure black.

By the time that it is fully grown, at an age of about 2 months, the young bird has assumed its juvenal or first real plumage, in which it is heavily mottled above with "hair brown" and pale "avellaneous"; the feathers of the lower back and the scapulars are "clove brown" centrally, broadly edged with "avellaneous" or "wood brown"; the cheeks are plain "hair brown"; and the crown is "hair brown" streaked with "light buff." This plumage is worn but a short time and is replaced in the fall by the first winter plumage, which is acquired by a partial molt, involving part, or perhaps all, of the contour feathers, but not the wings and tail. I am inclined to think that part of this change is effected by wear and fading of the brown edgings.

The first winter plumage, deep blackish brown, mottled with grayish white, with the uniform dark primaries and rectrices, and with the bill wholly dusky, is worn throughout the first year or until the first postnuptial molt, when the bird is about 13 or 14 months old. A complete molt then occurs, at which time the slaty blue mantle is, at least partially, acquired, and the bill becomes yellow on the basal half. The new primaries are still wholly black and the tail wholly black or mottled with white near the base. The contour feathers or head and underparts are still mottled with dusky, but become lighter during the year by wear and fading. There is much brown still remaining in the wing-coverts. During the second spring there is a steady advance toward maturity, with great individual variation, the molt beginning as early as April in some cases. At this second postnuptial molt, which is complete, the wings of the adult, with black primaries tipped with white, are acquired, but there is sometimes more or less brown in the wing coverts; the tail becomes white with a subterminal black bar; the white body plumage appears, though it is much clouded with dusky in the fall; and the bill still remains dark at the tip. The fully adult plumage seems to be acquired perhaps a year later, when the bird is 3 years of age; this, of course, is characterized by the pure white tail and the yellow bill. Some birds, otherwise adult, during the fourth winter, have more or less dusky mottling in the tail, and some lack the subapical white spot, or have only a small one, on the outer primary. As these birds and those with the black-banded tail and brown wing coverts are comparatively rare, it may be that these are merely backward or less vigorous birds, and that normally vigorous birds acquire their fully adult plumage when 3 years old. I am inclined to think that this is so, but, as I am not sure of it, I have given what seem to be the facts in the case. The seasonal molts of the adult consist of a complete postnuptial molt in the summer and a partial molt about the head and neck in the spring. In spite of statements in some of the books to the contrary, adults have the heads streaked with dusky in the fall, which markings disappear by wear or fading, or perhaps by molt, before spring.

Food.—Before the encroachments of civilization gave the western gull an easy way of earning its living as a scavenger, its principal food supply was gleaned from the sea; it followed the schools of small fish in flocks, hovering, screaming, and struggling for its prey in strenuous competition. When its appetite was satisfied a game of tag sometimes ensued, such as Mr. J. H. Bowles (1909) described as follows:

> One catches a herring, and instead of eating it flies with the fish hanging from its bill, past three or four comrades. These accept the challenge and rush madly after, while the pursued goes through all sorts of evolutions in seeking to elude them. If overtaken, the order of chase is reversed, and the game goes merrily on until all are tired. The fish, or tag trophy, is not eaten but is dropped upon the playground in a condition decidedly the worse for wear.

Although fish still form a large part of its food, especially about its breeding grounds, it is primarily a scavenger, like the other large gulls, and has learned to frequent harbors and populated shores, where it can easily gorge itself on the garbage dumping grounds, pick up unsavory morsels at the outlets of sewers, and feed on whatever refuse it can find scattered along the beaches. It also follows vessels to pick up whatever scraps of food are thrown overboard. It feeds at low tide on the sand flats, mud banks, river shores, and mussel beds, where it finds dead fish, clams, seaworms, dead rats, or any kind of fresh animal food or carrion. It understands how to break the shells of a clam or a sea urchin by flying up into the air with it and dropping it on hard ground or on a rock, sometimes making several attempts before succeeding.

Mr. Walter E. Bryant (1888) says of its feeding habits:

> The gulls are indiscriminate feeders; in addition to their usual articles of diet, they subsist largely upon eggs during the summer. They do not eat the eggs of their own species, nor do they trouble the cormorants after the murres have commenced laying. Sea-urchins, crabs, young murres, and rabbits, and fish stolen from the cormorants' nests are eaten. Not being quick enough to swoop upon the rabbits they catch them by patient watching at their burrows, and will patiently try for 15 minutes to swallow a squealing young rabbit, and finally fly away with the hind feet protruding. The dead bodies of murres are also eaten; they detach pieces of flesh by backing away and dragging the body, meanwhile shaking their heads, till a piece breaks off.

Perhaps the most important food supply of the western gull on its breeding grounds consists of the eggs of other birds, near which it almost always nests. The sagacity displayed by the gulls in taking advantage of the human egg hunters is well described by Dr. A. L. Heermann (1859) as follows:

> At 1 o'clock every day, during the egg season, Sundays and Thursdays excepted (this is to give the birds some little respite), the egg hunters meet on the south side of the island. The roll is called to see that all are present, that each one may have an equal chance in gathering the spoil. The signal is given, every man starting off at a full run for the most productive egging grounds. The gulls understanding, apparently, what is about to occur, are on the alert, hovering overhead and awaiting only the advance of the party. The men rush eagerly into the rookeries; the affrighted murres have scarcely risen from their nests before the gull, with remarkable instinct, not to say almost reason, flying but a few paces ahead of the hunter, alights on the ground, tapping such eggs as the short time will allow before the egger comes up with him. The broken eggs are passed by the men, who remove only those which are sound. The gull then returning to the field of its exploits, procures a plentiful supply of its favorite food.

I have repeatedly seen this gull drink salt water, and I believe that all ocean gulls do so, though I have heard it stated that they prefer fresh water. They do not, however, like their food too salt, as the following instance, related by Mr. A. W. Anthony (1906) will illustrate:

> I was one day watching some western gulls, a few yards from me on a wharf, when a large piece of salted fish was thrown out from an adjacent boathouse. It fairly glistened with a thick incrustation of salt, and I was somewhat curious to see if the gulls would eat food so highly seasoned. No sooner had it fallen than it was seized upon by a gull and as quickly swallowed; but from the surprised actions of the bird it was evidently not to his liking; no sooner had it reached the stomach than it was ordered out again. Dropping the fish on the wharf the bird eyed it for a moment, turning its head from side to side, and, to judge from its soliloquy, made a number of uncomplimentary remarks on the depraved tastes of mankind that would spoil good fish in that manner. Then picking up the fish it flew down to the water, and holding it under the surface shook its head from side to side violently "sozzeling" the meat about for several seconds. It was then taken back to the wharf, laid down and inspected, and carefully sampled; this time, however, it was not bolted as at first, but held for a moment in the mouth and again rejected, and carried back to the water, where it was even more roughly laundered. This operation was repeated several times; and the piece of fish, which must have weighted 4 ounces at the outset, was reduced to half that size before it reached a state of freshness that suited the palate of the gull.

Behavior.—The flight of the western gull is not unlike that of other closely related species; it has the same power of sailing directly into the wind, or within a few points of it, on motionless wings. I have seen it travel for long distances in this manner without any apparent effort. It also has the same soaring habits as other large gulls, rising to great heights and circling about on outstretched pinions, as if enjoying the exercise. While soaring it occasionally preens the feathers of its breast with its bill or raises one foot to scratch its head, without losing its poise. Once, while sailing before a strong wind, almost a gale, a lot of these gulls were following us to pick scraps of food which we were throwing overboard; it was necessary for them to face the wind and drift along tail foremost, so as to keep pace with our boat; they were not sailing or drifting, but were maintaining their positions by constant flapping and were apparently flying backwards. While flying the feet are extended backwards and buried in the plumage, but when about to alight they are dropped and spread. A sudden descent from a considerable height is quickly accomplished by a spiral or a zigzag glide, on half extended wings, with frequent quick tipping from side to side.

The cries and call notes of this gull are much like those of other species. Mr. Charles A. Keeler (1892) has given a good description of them, as follows:

> Their most common note may be expressed by the syllables *quock kuck kuck kuck*, uttered very rapidly in a low, guttural tone. Sometimes it was varied thus *kuck kuck kuck ka*, the quality of tone being the same as in the first instance. Frequently a higher cry would be heard, which may be indicated by the letters *ki aa*, with a strong accent on the first syllable. Again, one would utter a rattling, guttural cry, which sounded like a man being throttled.

The behavior of western gulls toward their neighbors is truly scandalous. They must be cordially hated and seriously dreaded by the various species among which they nest, for they are arrant thieves, ever on the alert to improve every opportunity to steal and devour any unprotected eggs or young which they can find. They usually select a breeding place among nesting colonies of cormorants, murres, or pelicans, chiefly because they can there find an abundant food supply in the nests of their peaceful neighbors. Cormorants, being rather shy, are easily driven from their nests by human intruders and do not readily return, so that the gulls often succeed in cleaning out a whole colony. Eternal vigilance is the price of success in rearing a brood with such rogues roaming about and looking for the slightest chance. The cormorants and pelicans have to sit on their eggs constantly from the day they are laid, or the gulls will get them. This will account for the fact that the young in the nests of these species are often of widely differently ages. Even the young have to be constantly brooded, for the gulls will swallow the smallest young whole and mutilate or beat to death the larger ones. Mr. A. W. Anthony (1906) has graphically described this perforance as follows:

> The advent of man in the region of a cormorant rookery is hailed with delight by every gull on the island, but to the poor cormorant it is a calamity of the darkest hue. As the frightened birds leave the nests, which have so far never been for a moment left without the protection of at least one of the

parents, the screaming gulls descend in swarms to break and eat the eggs or kill the young, as the case may be. Small cormorants are bolted entire, despite their somewhat half-hearted protest; larger birds are dismembered by two gulls assisting in the operation, after the well-known manner of barnyard chicks with a worm; and before the adult cormorants have recovered from their fright and returned to protect their homes a colony of several hundred nests will be almost destroyed. I have found young western gulls feasting on cormorant squabs half a mile or more from the nests from which they had been abducted.

Mr. A. B. Howell writes:

These robbers are surely the pest of their range during the spring months. When the pelicans and cormorants are flushed from their nests, down comes a devastating army of the marauders, spearing the eggs with their bills and neatly devouring them on the wing, pecking holes in the skulls of the young pelicans for the fun of it, and bolting the shiny cormorant chicks with a great gulping and show of satisfaction. A favorite pastime of theirs is to pester a half grown pelican until the latter relinquishes his last meal as a peace offering, and this the gulls greedily fight over. The gulls themselves have few enemies, except man, and now that egging has been practically stopped they are free to increase and flourish.

Winter.—After the breeding season is over and the young gulls have become strong on the wing, they begin to scatter and spread out all along the coast, extending the winter range of the species northward to Puget Sound, where it is one of the common winter gulls. They are given to wandering at this season, following the vessels up and down the coast, chasing schools of fish, feasting on the garbage dumps, roosting on the islands at night, and associating freely with other species of gulls, cormorants, pelicans, and other sea birds.

DISTRIBUTION.

Breeding range.—Pacific coast of North America, from British Columbia and Washington (various islands off the coast) southward along the coasts of Oregon, California, and Lower California, on nearly all suitable islands, at least as far as Cerros and Guadalupe Islands; also in the Gulf of California (San Pedro Martir, Ildefonso, and Carmen Islands).

Breeding grounds protected in the following national reservations: In California, Farallon Islands; in Oregon, Three Arch Rocks; in Washington, Copalis Rock and Quillayute Needles, as Carroll Islet.

Winter range.—Practically resident throughout its breeding range. North in winter to British Columbia and south to southwestern Mexico (Isabella and Tres Marias Islands, Tepic).

Egg dates.—Farallon Islands: Fifty-five records, May 12 to July 10; twenty-eight records, June 3 to 24. Coronados Islands: Ten records, May 6 to June 30; five records, May 11 to June 4. Washington: Seven records, June 3 to July 12; four records, June 3 to 14. Gulf of California: Three records, April 5, 6, and 7.

LARUS FUSCUS AFFINIS Reinhardt.

BRITISH LESSER BLACK-BACKED GULL.

HABITS.

The Siberian gull is no longer entitled to a place on our list, which it has held ever since the type specimen of *Larus affinis* was taken in Greenland and described by Reinhardt. The lesser black-backed gull of Europe and Asia has been subdivided into three subspecies—*Larus fuscus fuscus* Linnaeus of northern Europe, Scandinavia, etc.; *Larus fuscus affinis* Reinhardt of the British Isles, Faroes, and Greenland; and *Larus fuscus antelius* Iredale of Siberia. Reinhardt's bird, the type of *Larus affinis* and the bird which occurs as a straggler in Greenland was, until recently, supposed to be of the Siberian form. But Iredale has recently examined Reinhardt's type specimen and found it to be referable to the British form, the well-known lesser black-backed gull. He therefore gave a new name to the Siberian form, which necessitated the above rearrangement of the group, and makes it necessary for us to eliminate the Siberian gull from our list and enter in place of it the British lesser black-backed gull (*Larus fuscus affinis* Reinhardt).

Nesting.—This well-known gull occurs in Great Britain, both as migrant and as a resident, throughout the year. Much has been written about its habits. Dr. Henry O. Forbes (1898) writes of its breeding habits:

> In May the lesser black-backed gulls select their nesting place, betaking themselves, as Macgillivray states, "to unfrequented islands, headlands, and sometimes inland lakes (and mosses), often in considerable numbers, and there remain until their young are able to fly, although they make extensive excursions around in search of food." On the Teifi Bog, in mid-Wales, about 12 miles from the sea, the nests are placed "on slight hillocks, generally in deep heather, the vicinity, with trampled grass and scattered feathers, being suggestive of a goose green" (Salter). "In Hoy (in the Orkneys) anyone," writes Mr. Moodie-Heddle to Harvie-Brown, "can create a breeding place of the lesser black-backed gull by burning a large tract late in the season; the gulls then come on the bare ground (through the following summer and autumn) to catch moths and winged insects, which have no heather left to go down into. They then usually begin to breed on the tufts of white moss left unburnt the following season. The breeding places by the water of Hoy and down to Pegal Burn were thus formed by accidental fires. No gulls bred there for many years before, and we could kill 60 to 70 brace more grouse.
>
> In Iona, Mr. Graham notes that this gull made its nest on the flat, marshy summits of all the lesser islands. The nest is sometimes on the bare rock, but more often on a grassy slope, if such exist near. The most remarkable situation for a nest, perhaps, is that cited by Doctor Sharpe, which was placed in the middle of a sheep track, and the sheep, in passing to and fro, had to jump over the back of the sitting bird. This nest (with its four eggs) is now in the British Museum.

This species breeds in colonies, which in some places are very large, when their nests are placed so close to each other, that it is by no means easy to traverse their nursery without treading upon either the eggs or young. The nest, if on the ground, is little more than a scraped out hollow in the ground, lined with grass, seaweed, or herbage of any kind within reach; if on a rock, a larger pile of the same substances is built up in the selected niche or ledge. It is not at all uncommon to find the herring gull nesting in close proximity to it, only, however, in the more inaccessible ledges or summits. Three eggs are laid as a rule—four occasionally, sometimes only two—which vary very greatly in size, shape, and color. Many of them are hardly, if ever certainly, to be distinguished from those of the herring gull. They vary in size from 2⅜ to 3 inches in length, by 1⅜ to 2 in diameter. Ground color, from very pale gray, through olive-brown to greenish-blue or chocolate-brown, spotted and blotched, often more abundantly at the greater end, with black or dark brown. From the end of May, through June and into July, eggs and chicks of all stages and ages may be found.

Eggs.—Rev. F. C. R. Jourdain has sent me the following measurements of eggs of this gull from the British Isles: Eighty eggs average 68.04 by 47.39 millimeters; the eggs showing the four extremes measure **77.1** by 49, 72.5 by **52.1**, **58.6** by 45 and 61.3 by **43** millimeters.

Young.—Doctor Forbes (1898) says of the young:

After about three weeks' incubation the chicks break through their prison, as lively and nimble balls of down, grayish-buff above, with the head, neck, and back spotted with brown; the under side paler and unspotted. On the least intrusion on their cubicle they are ready to be off—running, as Mr. Battye remarks, head down and shoulders up like a falcon—to the nearest herbage or water for security; but if left undisturbed they may be found for a fortnight or more in the nest, most assiduously tended by the parents. The approach of any intruder when the helpless young are in the nests is the signal to set the whole of the colony on wing, wheeling round his head, swooping down upon and screaming at him.

Plumages.—When fledged, the bill, legs, and feet are livid corneous. The feathers, which are white in the adult, have a center streak, or a bar of ashy-brown, and pale edges; and where black they are reddish-brown, with yellowish-white edges. The wing feathers are sooty or black, and the tail is mottled with brown, which, near the end, becomes almost a continuous bar, the tips of the feathers being grayish-white; the bill is horn color, and the legs and feet brownish-white.

During its first autumn the bird undergoes no true molt, but the brown becomes less marked in some parts by loss of pigment, and more uniform through the wearing off of the pale tips. In the next spring there is a more general but slow molt, in which the brown comes in of a less deep shade, and during the second autumn its color becomes a little paler still. During the next year, in spring and autumn by feather-changes, and loss of pigment in them, the brown is still further lost; bill yellow at its base, but without the red spot on the angle of the mandible.

In the fourth autumn this gull has assumed almost the complete winter dress of the adult—the white spot near the end of the primaries perhaps alone not being well marked. The following spring, when the bird is in its fifth year, sees it in its first nuptial plumage. As soon as that interesting period is over the gull begins to assume its first mature winter garb, which differs only from that of the summer in showing brown streaks on the head and neck.

Behavior.—Macgillivray (1852) writes:

> The flight of this bird is peculiarly elegant, resembling, however, that of the greater black-backed gull, but more easy and buoyant, with the wings considerably curved. Its ordinary cry is loud, mellow, and somewhat plaintive, and when a number join in emitting it, which they sometimes do, when assembled for repose on an unfrequented beach or island, may be heard at a great distance and is then far from being unpleasant. It also emits occasionally a cackling or laughing cry, more mellow than that of the species above named. It searches for food on the open sea, in estuaries, on the beaches, and frequently on the land, sometimes flying to a great distance from the coast. Small fishes, crustacea, echini, shellfish, land mollusca, and earthworms are its habitual food, but it also eats of stranded fishes and devours young birds. When shoals of young herrings are in the bays, creeks, or estuaries it may often be seen in great numbers, intermingled with other gulls; but when reposing, whether on the sea or on land, it generally keeps separate in small flocks.

Doctor Forbes (1898) adds the following:

> Mr. Thompson notes that this gull is very fond of ascending rivers, as well as visiting inland lakes. Several of these birds may be seen, in winter and spring, in the river Lagan as far as the first fall above the sea, where the canal commences, the snowy whiteness and pure black of their plumage contrasting finely with the background of dark foliage of the river banks. On one occasion [continues the same naturalist] I observed an adult bird fishing * * * high up the Lagan, * * * while soon afterwards two immature birds flew up the course of the river until they joined him. They were no doubt the bearers of some particular intelligence, as immediately on their reaching the old bird he wheeled about and the three proceeded with their utmost speed down the river. In like manner I once observed several of the black-headed gulls feeding in a ploughed field, half a mile from the shore of the bay, whence a single bird flew direct to them; the moment it arrived they all wheeled about, and, with their best speed, made for the bay, where it was low water at the time. They were not in any way alarmed in the field; the courier seemed to convey some special news.

DISTRIBUTION.

Breeding range.—The British Isles from the Faroes to the Channel Islands, on the coasts of France and probably Spain; south to Alboran Island off Morocco. From the Scandinavian Peninsula eastward it is represented by another subspecies.

Winter range.—From the British Isles south to the western Mediterranean, the Canary and Madeira Islands, and the west coast of Africa.

Casual records.—The type specimen was taken in Greenland, which is the only North American record.

LARUS ARGENTATUS Pontoppidan.

HERRING GULL.

HABITS.

Contributed by Charles Wendell Townsend.

The most widely distributed sea gull of the Northern Hemisphere and the one that is best known because it frequents the haunts of man, visiting his most populous harbors,, is the herring gull. But slightly inferior in size to the great black-backed and burgomaster gulls, it is distinguished from the former by its pearly gray back and from the latter by the black tips to its wings. Not only is it a bird familiar to those dwelling along the seacoast and to the voyagers on the ocean, but it is found about lakes and rivers. Owing to better protection given to breeding colonies, which were formerly systematically robbed of their eggs, and to the fact that the birds are not molested in the neighborhood of large cities, the herring gull has not only held its own, but is undoubtedly on the increase.

Circumpolar in distribution the herring gull breeds from Ellesmere Land to Manitoba and Maine, and in Europe to northern France and the White Sea. It winters wherever there is open water throughout its range, and as far south as Cuba and the Mediterranean Sea. In northern regions the return of open water in the spring often determines the arrival of these gulls as well as of other water birds. An interesting example of this is shown in the case of Cobalt Lake, Ontario, where a constant stream of hot water flows into the lake from the silver mines. As a consequence the ice leaves sometimes as much as two weeks earlier than it does in any of the surrounding lakes. Arthur A. Cole (1910) reports that in 1910 "the lake opened on March 31, and within 24 hours two herring gulls were seen floating in the lake."

On the eastern coast of the United States the herring gull spends not only the winter but also the summer to a considerable distance to the south of its breeding range, the most southern point of which is No-Man's-Land in Penobscot Bay, Maine.[1] In southern Maine and on the New Hampshire and Massachusetts coasts it is difficult to state the dates of migration, for the birds is always to be found there.

Courtship.—In the spring one may often see on a sand bar some of the herring gulls walking proudly about raising and lowering their heads and emitting from time to time loud sonorous notes, a bugle call which I believe to be their love song, while others stand quietly by. As this song is given the head, with wide-open bill, is raised until it points vertically upwards and then lowered to the horizontal

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[1] A few herring gulls have recently bred near Marthas Vineyard.

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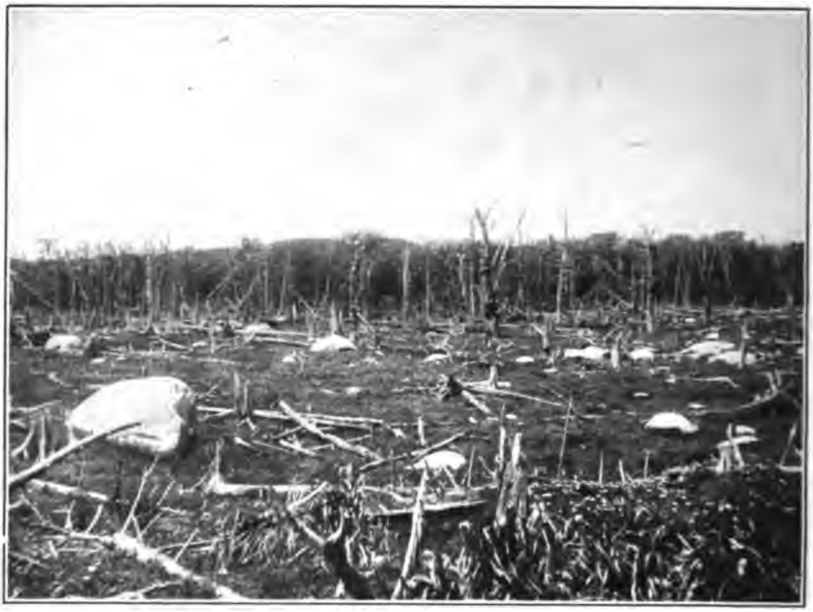
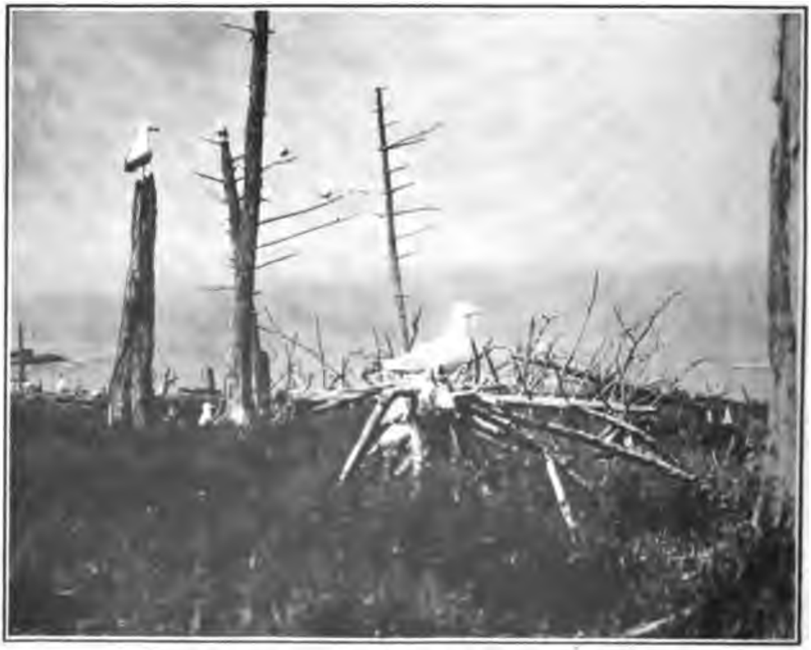


Heron Island, Maine. A. C. Bent.



Little Spoon Island, Maine. A. C. Bent.

HERRING GULL.

FOR DESCRIPTION SEE PAGE 331.

position. As the sex can not be distinguished one may only guess that it is the males that are thus parading themselves. At this time of year, more than at other times, they are frequently to be seen chasing each other in the air, and that too without the object of stealing coveted food morsels. Mr. Ralph Hoffman reports seeing a pair of these birds bowing to each other at Ipswich beach just prior to the act of mating. On the ground they sometimes seize each other by the bills and strike with the wings and feet. H. L. Ward (1906) describes an action on the part of the gulls which suggested to him the dance of the albatross at Laysan. He says:

> Two adults may be standing near together, when one will stop, hold its neck nearly horizontal, its bill pointed down, wave its head in and out from its body, and slightly up and down, in a rapid, jerky way, reminding one somewhat of the motions of a duck feeding in shallow water, at the same time emitting a peculiar chickenlike chatter. The other one immediately joins in, apparently directing its attention to the same place in the ground, and the performance is kept up for a minute or two, when the birds straighten up, perhaps to repeat the operation two or three times with short intermissions.

Nesting.—The herring gull breeds in small or large colonies, but always in the neighborhood of some body of water—a river, lake, or the sea. Single nests are rare, and usually point to the breaking up and scattering of a colony, for the herring gull is a very social creature and prefers to nest, feed, rest, and sleep in companies. Mr. Brewster in 1881 found many of the herring gulls on the southern coast of Labrador nesting in widely scattered regions, and says (1883) "the policy of scattering over wide areas, however, probably preserves the majority of nests from discovery."

At the Duck Islands off the coast of Maine is a large breeding colony which has been protected for some years. Previously the colony was despoiled of eggs every year by fishermen, and many of the birds had acquired the habit of nesting in trees, where they were less likely to be robbed. Herring gulls have resorted to trees as nesting sites when disturbed by man in places other than these Duck Islands. Audubon (1840) in 1833 found the gulls nesting in fir trees on Grand Manan Island. He was informed that the habit had been acquired within the recollection of those living there, and that previously they had nested on the ground. Dr. Henry Bryant visited the same locality in 1856 and found that fewer were building in trees than in Audubon's time—a fact he attributes to greater freedom from persecution. Barrows (1912) says that he has never known herring gulls to nest in trees in the Great Lakes region, When I visited the Duck Island in 1904 the birds under protection had returned with few exceptions to the normal habit of nesting on the ground.

Maj. G. Ralph Mayer, United States Army, contributes the following description of the nesting colony at Great Duck Island, Maine, which he visited on June 20, 1913:

> Great Duck Island is about 2 miles long and from three-fourths to 1 mile wide at its greatest width. The gulls' nesting ground extends clear across the island in the open rocky ground and even back into the edge of the woods among the second or third growth. The nests are placed almost anywhere, though usually against a tree trunk or stump. Some are placed among the rocks along the shore. There are three nesting trees on the island. The greater part of the nesting ground has a peculiar soil of rotten vegetable matter and is thickly scattered over with dead trees, standing and fallen. There are probably 4,000 pairs of birds nesting on Great Duck. Little Duck Island, which is about 1 mile north of Great Duck, is the home of about 6,000 pairs of the birds.
>
> The nests, as a general rule, are very rough looking structures, though there are some exceptions. The shape and size varies considerably with the location. The materials used were varied. In one part of the island where chickweed was plentiful this was used to the exclusion of all other materials excepting a few sticks for the base of the nest. On the higher ground the predominating materials were chips and pieces of the dead and rotten trees in the vicinity. Some nests were lined with grasses or feathers; others had no lining whatever, but were more like mere beds of chips and decayed vegetable matter. In the walls of one nest I found a bristle brush of the kind used in washing bottles. The tree nests were composed of branches and were lined with grasses. Several nests found in the woods on Little Duck were composed of sticks and were lined with mosses, principally *Usnea longissima*, which was very plentiful in the vicinity. These were the best constructed nests I found. In all cases they were larger than those in the open. Mr. Gray, the head light keeper, told me that this was the first year he had seen them nesting in the heavy timber.
>
> The birds are quite bold in the defense of their breeding grounds. I have repeatedly seen them drive sheep and lambs from the vicinity of the nest, and only once did I see the sheep offer any resistance whatever, and in that case she very quickly decided that it was better to leave the vicinity. On two occasions I was charged by the birds. They did not touch me, but would swoop down straight at me until from 15 to 25 feet from me and directly overhead, when they would go up almost vertically and circling back, repeat the performance. When passing overhead they would utter their piercing "kee-ew." It was really exciting at times to see the bird heading directly at me and coming so fast. Mr. Gray told me that they made little attempt, however, to defend their nests against the crows, and that in some years a great deal of damage was done in this way. I watched the birds for some time from a tent. My notes show that six minutes after I entered the tent the birds had quieted down. I noticed one bird picking up nesting material several times, but it appeared to be a nervous action rather than a desire to collect nest material. Several times the birds had fights, in which each got hold of the other's bill and pulled.
>
> The following, taken from my notebook, was written about 5 p. m. on a clear, bright day:
>
> > This is one of the most wonderful sights I have ever witnessed. The air is literally full of gulls. In sight there must be at least 4,000 gulls and all screaming. It is a weird sound. The air is so full of them that it looks like

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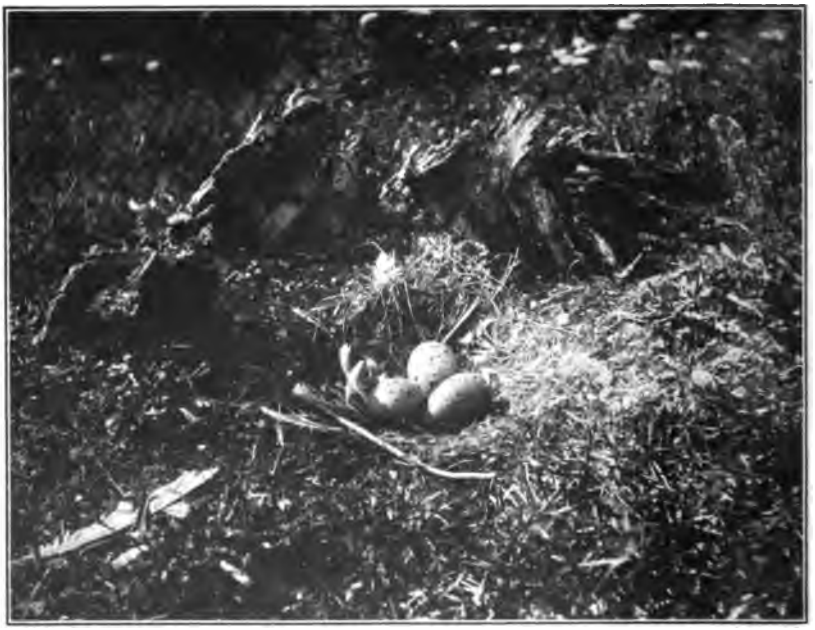
Seal Island, Nova Scotia. A. C. Bent.



Heron Island, Maine. A. C. Bent.

HERRING GULL.

FOR DESCRIPTION SEE PAGE 331.

> a snowstorm. They are perched on the trees and standing on the ground, where they resemble nothing so much as a national cemetery with its thousands of white stones. When I first arrived at Great Duck the birds did not appear to mind my walking around among the nests so much as they did later on. When I entered the nesting ground the birds within 50 to 100 feet of me would rise and fly around, calling. Later on during my stay the birds within 200 to 250 feet would rise. This may have been due to the fact that young were hatching out every day.

On the ground the nests are placed in hollows or in plain sight on sand or gravel or rocks, or in grassy fields. Sometimes they are placed at the foot of stumps or close to an overhanging rock or pile of driftwood; sometimes on the ground in thick spruce woods. They also nest on ledges on the face of cliffs, as at the Gaspe Peninsula. A. H. Jordan (1888) found a few nests on an island in Lake Champlain, where the birds were much persecuted, "quite well concealed in the edge of the woods under low-hanging trees." An unusual nesting site of the herring gull is mentioned by F. S. Daggett (1890), who found on Isle Royale in Lake Superior four nests of this bird built on the ice accumulated on the rocks by the dashing of the waves in winter. A few warm days had already so melted the ice that the nests with their contents were in danger of falling into the lake. He also speaks of nests made in hollows in the accumulated droppings of the bird.

Dutcher and Bailey (1903) say:

> During incubation the weight of the sitting bird breaks down or packs the nest, so they are continually being repaired and built up around the edges with new material, which is always green grass or weeds, the effect being very pretty indeed. On several occasions gulls were seen gathering this material in their bills. The grass is bitten off or pulled up by the roots until the bird has a ball in its bill larger than a man's fist. This material is gathered where it is most plentiful and is usually carried by flight to the nest site.

Baird, Brewer, and Ridgway (1884) describe a nest built in the top of a spruce, 60 feet from the ground, at Grand Manan, which was firmly built and "composed entirely of long, fine, flexible grasses, evidently gathered, when green, from the salt marshes, and carefully woven into a circular fabric. The nest measured about 18 inches in diameter, its sides being 3 or 4 inches thick, and its cavity at the center at least 4 inches deep." Ward (1906) observed incipient nest building at Gravel Island in Lake Michigan, and says that "there seemed to be no attempt to arrange the material with the bill," but that the bird molded the nest with her breast.

Dutcher and Bailey found at Duck Island, Maine, the average depth of the bowl to be 3 inches and its diameter 10 inches. The diameter of the nests at the base varied from 13 to 24 inches; they are sometimes built up to a height of 10 inches. Maj. G. Ralph

Meyer found that the size of the nests at the Duck Islands varied greatly. He writes:

> The average of seven nests was: Outer diameter, 15 inches; inner diameter, 8 inches; depth outside, 4¾ inches; depth inside, 3¼ inches. One nest in the heavy timber measured 22 by 8 by 6 by 5. One of the tree nests was 28 inches in diameter.

Eggs.—Only one brood is raised, but when the nests are frequently robbed the birds are kept laying all summer. Three eggs constitute a set, although the number is sometimes only two, and in very rare cases one or four. The color of the eggs varies within wide limits. Dutcher and Bailey, from an examination of many hundreds at Duck Island, Maine, found that:

> The ground colors were light sky blue, dead blue, light blue-gray, light gray-blue, dark lilac-gray, light gray, light pea-green, green drab, warm drab, ocher drab, pink drab, light brown, and cinnamon. The colors of the markings were chocolate brown, rich brown, light brown, snuff brown, asphalt, black, lilac, mauve. The shape of markings was almost infinite—large and small spots, indistinct specks, blotches, lines, and irregular streaks, somewhat like the markings on the eggs of blackbirds. One egg was found with a light sky-blue ground color with tiny indistinct specks of lilac and light brown. Some of the markings were so confluent that they resulted in a distinct line around the egg.

Major G. Ralph Meyer writes:

> The eggs varied greatly in shape, size, and color. Eggs were found varying from short ovate to cylindrical ovate. The most common shape was the elongate ovate.

The measurements of 45 eggs, in the United States National Museum and by Major Meyer, average 72.3 by 50.5 millimeters; the eggs showing the four extremes measure 82 by 52, 74.5 by 53 and 58 by 45 millimeters.

Young.—The period of incubation varies from 24 to 28 days, the average being 26 days. Dutcher and Bailey found an interval of about 12 hours between the hatching of each egg. Dutcher and Bailey (1903) show conclusively that in some cases at least both sexes incubate. They say:

> It was also observed that as the period of incubation neared its end the anxiety of the parents increased in a marked degree, so that it was easy to determine the stage of incubation by the action of the parents. During the last few hours, before the pipping and cracking of the egg, the parent birds were so fearless that they would leave the nest only on a near approach.

Several observers have found that the eggs were turned slightly by the bird's bill, feet, and breast. The mate of the sitting bird is often stationed near at hand.

The young are soon on their feet after leaving the egg, and, according to Dutcher and Bailey, "the instinct to hide seems to be developed within an hour or two after hatching." They conceal themselves or sometimes only push their heads under pieces of wood or projecting rocks or in the grass. The object of this habit may be also a desire

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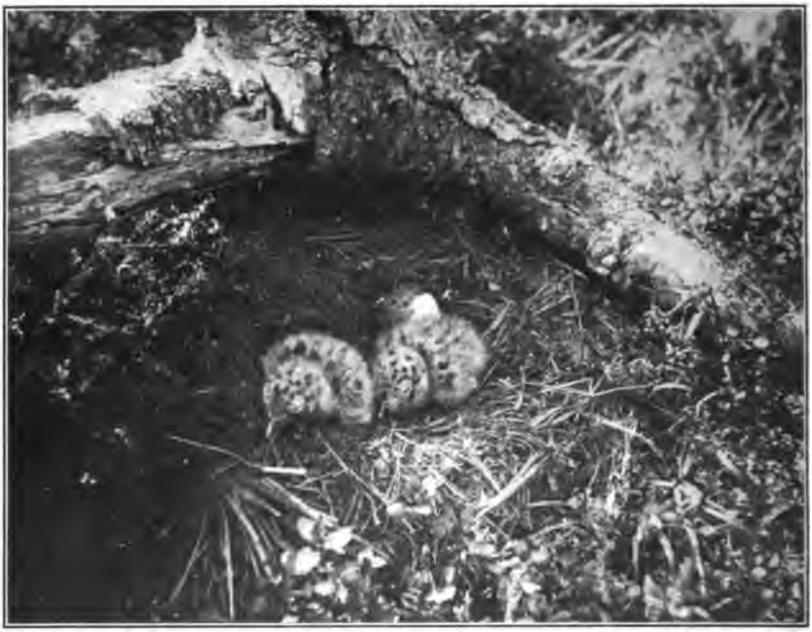
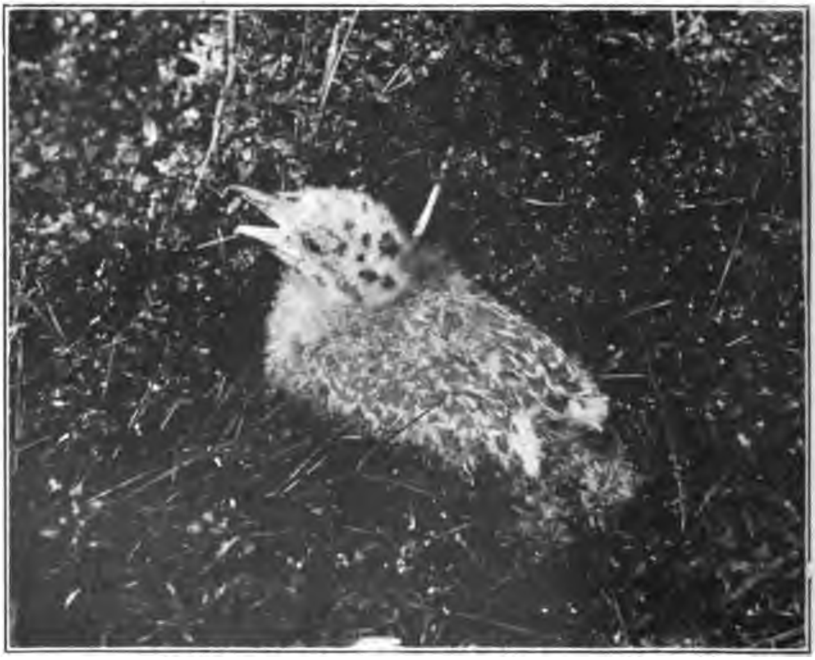


Heron Island, Maine. A. C. Bent.



Matinicus Rock, Maine. H. K. Job.

HERRING GULL.

FOR DESCRIPTION SEE PAGE 331.

for coolness and shade. Audubon (1840), speaking of the herring gulls breeding in trees at Grand Manan, says:

> The most remarkable effect produced by these changes of locality is that the young which are hatched in the trees or high rocks do not leave the nests until they are able to fly.

This is conspicuously the case at Percé Rock in the Gaspé Peninsula and on the lofty cliffs of Bonaventure Island and Bon Ami.

One of the parents guards the young during the first week or two of life, repelling intruders, and the young are brooded and shielded from the sun.

R. M. Strong (1914) describes the feeding of young only a few hours old as follows:

> The adult bird did not insert its bill in the mouth of its offspring, but the latter took food from the ground just below the bill of the parent. * * * A quantity of food in a fine and soft condition was disgorged in more or less of a heap.

Meyer writes that "in feeding the very young bird the parent holds the food in the bill and the young bird picks it out. The older birds take their food from the ground, where it is placed by the parents." Ward (1906) thus describes the feeding of young nearly able to fly:

> The young comes in front of an adult and with a bowing and courtesying movement puts up its bill to that of the old one, continuing the bowing for several minutes, resting between times. Sometimes it took hold of the adult's bill with its own; at other times merely touched bills. When the adult opened its mouth the young put its bill within. Failing to get indications of food it went to another adult, and repeated the operation, passing in succession to several, until at length it seemed to get some favorable signs, for it remained by this one, alternately begging and resting. After some time, it was apparent to me that the adult was striving to regurgitate. It would open its mouth, stretch its neck nearly horizontally, then bring its head down to the ground. * * * Perhaps half an hour after these efforts began I saw a portion of a fish appear in its mouth, and a moment later it was deposited on the ground, where the young promptly seized it. The fish appeared to be a herring about 7 or 8 inches long and so mascerated that it readily fell apart.

I have observed adults at Percé Rock very promptly regurgitate for their young on alighting near them.

This feeding is done by both parents; and even after the young are able to gain a fair livelihood by their own exertions, and have gathered in companies by themselves, they are ever on the alert to beg food not only from their own parents, but from any adult that may come in their way. It is thought by some that the adults in their turn feed any that come along, but it is probable that the adults recognize their own offspring and as a rule refuse to feed any other, except when they are so set upon by the mob of clamorous young that they must perforce submit. The young are fed for at least five weeks, or until they are able to fly, and even for some time after this whenever the adult can be induced to part with some of its food. Young gulls swim readily, and when frightened will sometimes take to the water and swim rapidly away.

An astonishing habit of herring gulls that has been observed and described by various writers is that of infanticide, and the murder is committed not only on the very young, but also on those nearly grown. Ward (1906*a*) says:

> The main point of attack was the back of the head. To this region a number of severe blows were given with the point of the bill, after which it was grasped between the mandibles of the adult and the bird was pulled about until the skin and flesh were cut through to the skull.

He was unable to find that these victims were abnormal or had given offense. The habit may perhaps be due to the ferocity of the guarding and fighting instincts in the old birds, and a lack of attunement in the instincts of the young, in consequence of which a chick will occasionally stray from its own preserve and trespass on the domain of a neighbor. Meyer quotes Mr. Gray, the lighthouse keeper of Great Duck Island, as saying "that some of the old birds would kill young gulls and even young chickens. They would take the young bird by the neck and choke it. He put a stop to that by killing the bird found in the act."

Examination of stomach contents of young herring gulls reported by Dutcher and Bailey (1903) showed that, besides fish and squid, various insects (moths, flies, and beetles) had been eaten. As a rule the young are given the same food that is consumed by the adults and this will be described later. In two stomachs of birds 1 and 2 days old examined by me I found wasps and large June beetles.

Plumages.—The downy young are of a buffy yellow color, nearly white below and dusky on the back. They are thickly marked with black spots above. The bill is horn color, with a pink tip after the white pipping knob has disappeared; the feet, dusky pink. The growth of the young gull is rapid, and at the age of 5 or 6 weeks it has donned the juvenal dress, of which the prevailing color is dark gray tinged with brown. The upper parts are mottled and barred with grayish buff and white; the head and neck are streaked with white; the breast and belly nearly uniform ashy-fuscous. The primaries and tail are brownish black. The eyes are brown; the bill dark, pale at the base; the tarsi and feet grayish flesh color. There is a partial molt in the fall of the first year into the first winter plumage and a partial one in the spring into the first nuptial plumage; but no essential change in the general color of the feathers. In the spring and summer the large flocks of herring gulls that are to be found south of the breeding range are largely made up of these dark plumaged year-old birds. In the fall of the year following the one in which the birds are hatched—that is, in the second winter—the "gray gull" molts into its second winter plumage, a dress which approaches that of the adult in its pearl-gray back and white belly, but the former is mottled with brownish and the latter clouded with dusky. The head, neck, and rump are heavily streaked with gray, the primaries are black, and the tail appears to be tipped with black, owing to the dusky brown mottling of the white feathers. A partial molt in the spring into the second nuptial plumage still further improves the dress. A few individuals of this age (2 years) with black tips to the tails and streaked breasts are to be found in the breeding colonies, but none of those in the gray of the first nuptial plumage. Not until the third year or later is the full dress assumed with perfect blue gray mantle, snowy heads, breasts, rumps, and tails, and with primaries tipped with white. Astley (1901) states that the bright yellow bill is not attained until the fourth year. There is then a carmine spot on the lower mandible; the irides are yellow.

There is also a seasonal molt, by which a slight streaking of the neck is assumed in winter, but it is probable that this diminishes and may vanish with age. According to Dwight (1901) the limited prenuptial molts occur on the Atlantic coast in March and April, and the complete postnuptial molts in August and September.

Food.—The food habits of the herring gull are of considerable importance, for the bird is a scavenger and renders great service in keeping the harbors and beaches free from decaying fish and refuse of all sorts. All is game that comes in their way, but their greatest prizes are thrown from fishing vessels when the men are cleaning fish. At these times they crowd around the sterns of the vessels and dash eagerly for the choice pieces, the air being filled with their screams. The method of picking up food from the water is characteristic and graceful. Down they swoop on outstretched wings and spread tails with feet dropped to the water, where they often seize the morsel without wetting a feather save perhaps only the tips of their tails, which are curved downward. Often the birds must needs check their course by back paddling with their wings or even by flying up almost backwards. If the morsel is large thy sit on the water for a moment or two to swallow it, and thus drop behind the fishing vessel which, however, is easily overtaken. There is many a slip twixt the cup and the lip, however, for the birds are often made to share the booty with other gulls who have had their eyes on the same dainties, or even to lose it altogether when pursued by a more powerful rival. The great black-backed gull plays this rôle with great effect.

The scows which carry off the city garbage to be dumped in deep water are also eagerly followed by the gulls and much booty is gleaned when the vessel is discharged. In the harbors of populous cities there is always food to be found floating on the water, particularly in the neighborhood of fish wharves and at the mouths of sewers. The service to sanitation in these places is of great value. At Boston large quantities of sewage are poured out into the harbor at Moon Island just after the tide begins to ebb. Gulls collect from all sides in anticipation of this event and rest on the water offshore or fly to and fro until the sewer gates are opened. Then, heedless of the onlookers, they fly in crowded ranks close to the unsavory fountain head and dip gracefully for the titbits to be found there. It is an interesting fact and an indication of considerable intelligence that gulls, although very wary in regions where shooting is carried on, become entirely tame and confiding where this is forbidden, as is the case in harbors and bird reservations.

At times, however, but not often, the herring gull resorts to the tactics of the tern, and captures small live fish by plunging headlong into the water. Occasionally this plunge is made from a height of 15 or 20 feet, and the bird disappears below the surface, soon to emerge with its prey. Sometimes a whole flock can be seen engaged in this occupation as they follow a school of fish. At other times, the plunge with partly open wings is made from only a few feet above the surface, and the bird is only partially immersed. I have seen the members of a flock of herring gulls riding in shallow water fly up a few feet into the air in order to obtain impetus for a short dive below the surface for some prey. Knight (1908) describes the plunging of these gulls from the air and says:

> They flew about the open water in circles * * * and as their keen eyes detected some fish at this upper portion of their range they plunged with force into the water, quickly rising to the surface as a usual thing, though on at least one occasion a bird was out of sight so long that I had grave fears that it would be carried under the ice by the swift current, but it finally emerged at the edge of the ice and took wing with an unsually large tomcod. Nearly every plunge seemed to be successful, the birds swallowing the smaller fish before taking wing, but when a large fish was captured they would fly to the ice near by and after batting the fish from side to side on the ice would finally swallow it.

When herring are caught in pounds and traps there are some dead or dying fish that are captured by the gulls, which have, therefore, been accused of damaging the fishery. It is probable that their work here is more properly that of scavengers in keeping the traps free from dead fish, and, therefore, beneficial.

The sand beaches are at times covered with stranded fish, small and large; sand launces, herring, cod, hake, haddock, pollock, dogfish, and skates are often thrown up or cast themselves ashore, pursued and pursuers alike. Their dead bodies would soon become intolerable were it not for the greediness of the gulls who come from all sides to the feast. The small fry are eaten whole, while the larger bony fishes are gradually hacked to pieces until nothing but the skeleton is left. The tough spiny skin of the dogfishes and skates protect them until decay has allowed an entrance, and these are then partly consumed. Squid are also thrown up on the beaches and are relished by the gulls.

The herring gull has a curious habit of dragging dry fish from the upper beach to the water. I found on Ipswich Beach a fish, 18 inches long, that had been dragged by a gull 134 yards in an irregular course from the upper beach to the edge of the water. During the whole transit the gull walked backward, as was plainly shown by the tracks. In this connection the following by Strong (1914) concerning his captive gulls is of interest: He found that these gulls often rinsed a piece of food that "has been lying in a chemical solution, or when it has accumulated considerable dirt as a consequence of having been dragged on the ground. Such rinsing of the food does not occur at every feeding, but is usual." In the case of the gulls at Ipswich it would seem as if they wished to soften the food by maceration in the water.

From the beach and among the rocks of the seashore the herring gull obtains a variety of food other than dead refuse—crabs and other crustaceans, mollusks of all sorts, such as clams, mussels, sea snails, etc., and echinoderms and worms. Many crabs and mollusks are broken with the bill, but if this can not be accomplished the gull seizes the difficult morsel and flies up with it into the air, nearly vertically or in circles, drops it onto the hard sand or rocks, follows closely the descent, and alights to regale itself on the exposed contents. If unsuccessful the first time the gull tries a second and sometimes a third or fourth time. This habit, which is also a common one with crows, explains the fact that mollusk shells, crabs, and sea urchins are scattered so universally along our coast, sometimes half a mile from the sea. On the rocky coast of Maine, where the sea urchin (*Strongylocentrotus dröbachiensis*) is abundant, the gulls sometimes turn them over and pick out the flesh from the circular hole about the mouth without breaking the shell. Isely (1912) speaks of seeing a herring gull in Kansas "following a corn lister, picking up grubs like the blackbirds." In England, where the birds are more familiar with man, herring gulls not infrequently follow the plow to pick up worms and grubs.

From time to time complaint is made of the damage done by herring gulls in eating fish or fish refuse spread on land as a fertilizer, and one can hardly blame the gull for his failure to discriminate between harmful and useful refuse. It is probable that these reports are exaggerated, and it has been found that the birds are easily kept away by scarecrows.

Seton (1908) says of the herring gull in the region of the Great Slave Lake that it "will pursue wounded game and often follows the hunter to share in the kill." Mackay (1892) says that herring gulls will eat dead ducks with avidity, cleaning off the flesh and rejecting the skin and feathers as if it had been done with a sharp knife. He has known them to carry a dead red-breasted merganser "for nearly a quarter of a mile by stages of about 25 yards, holding it by the neck, in order to eat it in security." He also states that they watch mergansers and rush at them when they appear with a fish in the mouth, and he believes that they often secure the fish.

As has been stated above, insects of all kinds have been found in the stomachs of young birds. Coues (1877) speaks of finding the remains of a hare in a gull's stomach, and Eifrig (1905) seeds and berries.

The herring gull under some circumstances robs nests of the eggs and young, but not to such an extent as some other gulls. Mr. Manly Hardy reports finding a herring gull nesting within 8 or 10 feet of three red-breasted mergansers' nests and close by the nests of spotted sandpipers and common terns, none of which was in the least disturbed.

Herring gulls eject from their mouths the harder particles of food, such as fishbones and crab's claws, in the form of loosely compacted pellets; some 2 inches in length. These may be seen about their resting places. I have sometimes found a few feathers in these pellets, probably plucked from the bird's own breasts.

The fresh-water ponds and reservoirs along the coast are frequently visited by this splendid gull, and it is the common idea that they resort to these to drink fresh water; but it is to be remembered that in some places and times they stay continuously near salt water, and that Mr. Brewster's captive kittiwake refused fresh water, but drank salt water. In the interior on the fresh-water lakes and ponds where the herring gull breeds, and in similar regions where it spends the winter, it is evident that the bird must drink fresh water. Anthony (1906) says:

> That gulls drink sea water, and can thrive on it, is a fact not to be questioned; but I am of the opinion that when fresh water can be obtained without too much trouble they will drink it in preference.

Strong (1914) found that his captive gulls showed an aversion for salted food, and washed their bills and drank fresh water afterwards.

Behavior.—The flight of the herring gull varies greatly under different circumstances. At times, especially in calm weather, the birds flap along slowly with broad, slow wing beats like those of herons or cormorants. In this manner they may fly close to the water or high in the air, and they are usually massed in loose flocks.

Occasionally, however, their flight is in a long line, one behind the other, or in broad lines abreast, and rarely they may be seen in the typical V formation of ducks. In rising, a flock often ascends nearly vertically in a great circle all together, or in many intersecting circles. The play of light and shade, of sun and shadow, alternately make the birds appear dark and light. Many hours are spent by the gulls in this graceful and beautiful sport of soaring in circles—a sport which apparently requires but little effort, as, under favorable conditions, few wing beats are necessary. The descent may be made in the same manner as the ascent by circling, but at times the birds drop swiftly down by tipping or rocking from side to side.

In windy weather the flight of the herring gull is far from slow and heron-like. Then it is extremely graceful, as the bird alternately sails with great rapidity before the wind or beats up into it.

At times these gulls are able to sail directly into the teeth of the wind without a single stroke of the wing. Mr. William Brewster (1912) has described the manner in which herring gulls keep pace with a vessel, gliding along on almost motionless wings into the teeth of the gale, sometimes within a few yards of the deck, but always on the windward side. He says:

> As the gale increased they flapped their wings less and less often, until most, if not all of them, were gliding ceaselessly, minute after minute, over distances certainly exceeding a mile, without a single wing beat, but not without changes or readjustments in the bend or the inclination of the wings, which took place not infrequently and often were very obvious.

Several explanations of this mysterious means of propulsion have been offered, but the following by F. W. Headley (1912) seems to me the most satisfactory. He says:

> There is a feat perhaps more striking than any of the others already described—a feat which, nevertheless, gulls often achieve. A steamer is advancing against a fairly strong wind, which, if not absolutely a head wind, strikes the vessel at an acute angle. There results a steady up current over the stern of the vessel, or slightly to one side or the other of the stern. Poised on this up current the gulls hang in mid-air, their wings held rigidly expanded. Only very slight wing movements, evidently for purposes of balance, can be detected. Standing on the deck and watching these gulls one is irresistibly reminded of the poising of the kestrel high in air, with wings held motionless, when he finds a wind that is all that he could wish. It is sometimes easy to forget that, unlike the kestrel, they do not remain in one spot, but that all the while they are moving forward and, in fact, keeping pace with the steamer. The gulls, like the kestrel, are poising on an up current of air; but they give their bodies a rather different incline, with the result that they keep traveling forward. * * * The general incline of their body and wing surfaces is slightly downward. Hence the upward-streaming wind not only maintains them in the air or lifts them higher, but, acting at right angle, also drives them forward.

A similar explanation is given in detail by A. Forbes (1913).

It is probable that gulls take advantage of ascending currents of air when they soar in circles without perceptible wing beat. In descending from a height they often glide, or *vol-plane* in the modern language of the aviator, with amazing speed at a steep angle. At other times, as remarked above, they descend almost vertically by tipping first to one side and then to the other, with a suddenness that suggests falling. The last 20 or 30 feet is often accomplished slowly with upstretched wings and downstretched legs. There are very few birds whose flight is more beautiful or which will so well repay study as that of the herring gull.

In flight the feet are stretched behind under the tail, where they can be seen; but it is not very rare to discover a gull flying with one or both feet imbedded in the feathers of the breast, entirely covered or showing only a bit of the darker surface of the feet. I can hardly believe that this is for the sake of warmth, for it may occur on comparatively warm days; while even in the coldest weather the great majority of gulls fly with their feet exposed behind. In quick turns the feet are sometimes dropped, as if to aid in holding the air like a centerboard. They are also dropped as they approach the water, and at times dangle for several seconds as the birds rise into the air. Rising from the water or beach is easily accomplished against a strong wind, but in calm weather the bird is obliged to run along the sand or water for a variable distance before it can rise above the surface.

Although gulls are able to swim rapidly when winged and unable to fly, they rarely swim any distance under natural conditions. Their buoyant position on the water, with elevated tails, is well expressed by Oliver Wendell Holmes when he says:

> The gull, high floating like a sloop unladen.

The young just out of the egg are rapid swimmers and instinctively take to the water.

It is said by some writers that the herring gull never dives. This statement is, however, incorrect, as has already been shown in describing the feeding habits. In fact, under exceptional circumstances the herring gull dives as well as a tern.

The vocal powers of the herring gull have a wide range. This is particularly the case during the breeding season, when they indulge in all sorts of sounds, uttered it may be in conversational manner, in moods of love and passion, or anger and fear. Writers have described these sounds by syllables or by comparisions with other sounds in nature. Thus Ward (1906) says:

> Sometimes one hears sounds like the lowing of cattle, except that the pitch is higher, like the bleating of sheep, the mewing or snarling of cats, the clucking of hens, the crowing of cocks, hoarse human chuckles, and sounds for which I could find no comparisons.

Olive Thorne Miller says that the young herring gull has "a querulous cry like a puppy in distress."

I have often been struck with the resemblance of some of their notes to the rattling of blocks in the rigging of a vessel.

The usual alarm cry may be represented by the syllables, *kak-kak-kak*, or by a series of *ha ha has*. Herrick writes it as "*waw-wak-wak! wak-wak! wak-wak!*" Strong decided on the syllables "*kek-kek-kek*," with the accent on the first syllable. Ward also distinguishes a "challenge cry where the bird stretches its neck up at an angle of 45° and holds its whole body rigidly while the cry is emitted with great vehemence. This I have previously described under courtship. Bent's notes refer to this cry as the "trumpeting call" and state that this is

> the most striking and spectacular vocal performance of all the varied notes heard on the breeding grounds. It is usually given from a tree, stump, or other perch, but often from the ground. The neck is outstretched to its full extent, pointing upwards at an angle, and the mouth is opened wide. The call begins with a loud, shrill, prolonged scream, which is followed by a long series of shorter notes, rapidly uttered, sometimes as many as 10 or 12 in the latter. It sounds like *queeeee-ah, quak, quak, quak, quak, quak, quak, quak, quak, quak, quak.* As one bird starts on this call it seems to challenge others to join in the chorus, until perhaps a dozen birds are all giving it at once like a loud ringing chorus of college cheers.

Strong represents the call as *keee*, *kee ek*, *kee ek*, *kee ek*, *kee ek*, etc. I have noted it as *ko-ah*, *ko-ah*, etc., as well as *ku-ku*, or *kee ke*, *kee*, the last named high pitched and rapidly repeated. At times the notes are clear and bugle like; again squeaking or rattling; again the birds emit hissing whistles, which are very different from the other notes and very characteristic. There is evidently great individual variation in the notes as well as variations due to many moods and circumstances.

The herring gull associates with a number of other sea birds in the same haunts. With the great black-backed gull it has not infrequent encounters on the score of food, but it is fair to say that the larger bird is more often the aggressor.

Arthur Saunders writes:

> I have seen the common crow rob the gull of mussels which they have dropped on the rocks to break. The crows sit on the rocks until a gull drops a mussel near it, then walk up and seize the mussel before the gull has time to get it again. The gulls do not seem to resent this at all. They generally act as though they did not know where the mussel had gone to and fly off to hunt for another.

I have several times seen a herring gull fly at a whistler who was swimming near-by. The whistler always dove at the approach of the gull, who would settle on the water where the duck went down. In a few seconds he would start off for another duck, and the process would be repeated again and again. The gull never picked up any food from the water and never molested any ducks swimming near; and none of them showed any fear, except the one directly flown at, who would always dive before the gull reached it. It seemed to be a matter of play on the part of the gull that was understood as such by the duck, although it is possible that the gull hoped to obtain food. On one occasion I saw a herring gull fly directly at a female American merganser which with another was being courted by a male. The merganser flew vigorously away just as the gull alighted. Then began an active chase by short flights on the part of the gull, who was eluded by rapid turns and occasional dives on the part of the merganser. Finally the merganser came up close to the two other mergansers, who had remained passive during the pursuit, but as the gull pounced at the group they all took flight, closely followed by the tyrant. The mergansers easily distanced the gull, who in his eagerness spit out a small fish, but soon after gave up the pursuit and alighted on the ice.

Well endowed by nature to resist the destructive agencies of storm and cold, with practically no enemies among birds and mammals, the herring gull would indeed be a prosperous species were it not for the arch enemy, man. Fortunately, at the present date, the idea of bird preservation from an esthetic as well as from a utilitarian point of view is gaining ground, and since the beginning of the present century the herring gull has been more and more protected from gunners and eggers.

With many the benefit derived from this gull in sanitation (the removal from harbors of floating organic matter) is a strong argument in favor of protection. In the past, and to a large extent in such out-of-the way regions as Labrador at the present day, these gulls were and are incessantly persecuted during the breeding season. Their eggs are highly valued as a food supply, and the young are cooped up and fattened for eating. Adult birds are shot for food or for mere sport. It is fortunate that such practices are now frowned upon in all well-regulated communities.

A destructive agency of the young at breeding colonies is the surf on the shore. In stormy weather when the waves are high many young gulls, still unable to fly, are killed by being dashed on the rocks.

Like many other birds, it is probable that herring gulls enjoy considerable longevity, barring accidents. American ornithologists are familiar with the case of "Gull Dick," often reported by Mackay in "The Auk." For 24 years this bird—easily recognized by markings, voice, and disposition—visited the neighborhood of the Brenton's Reef Lightship in Narragansett Bay. Here it stayed from about

October 12 to April 7. The bird was fed regularly with boiled pork and fish. It would fly close to the vessel and would respond to calls or waving of the hand at mealtimes, and it jealously drove off all other gulls. Morris (1903) records another individual that was observed for at least 30 years.

Fall.—The fall migration from the breeding grounds at the Duck Islands, Maine, has been observed by the lightkeepers to begin about August 8, and by the 20th three-quarters of the birds have left. At Ipswich I have noted a decided diminution in the summer birds and a migration past the beach of adults by the 20th of August. As the herring gull is found in summer as well as in winter to the south of the breeding range, it is difficult to set exact limits in time for the migrations.

The usual explanation given for the occurrence of the herring gull in summer south of its breeding grounds is that these birds are immature or, if adults, barren individuals. On the coast of Essex County, Massachusetts, especially at Ipswich, is a place where nonbreeding summer birds can be studied to good advantage. Here, on the sandy beaches, they collect in numbers, which have noticeably increased of late years, since adequate protection has been extended to the breeding colonies farther north. As a large proportion of the summer birds at Ipswich are in immature plumage, it is probable that immaturity is the cause for nonbreeding to a considerable extent. A certain proportion, however, sometimes as many as 5 or even 10 per cent of the flocks, are in adult plumage. This fact and the fact that the number of gulls varies greatly from day to day, and that their numbers are greatest at the times when the beaches are covered with stranded fish, suggests that a certain proportion, perhaps only a small one, may be daily excursionists from their breeding places, the nearest of which, No Mans Land, is 111 miles northeast of Ipswich Light. Confirming this supposition are some observations made by me in June, 1904, on the Maine coast, where I found flocks of gulls flying southwest in the morning and northeast at night. The following from Dutcher and Bailey (1903) in the study of the gulls at No Mans Land and Great Duck Island, also bears this out:

> At daylight large numbers of gulls leave the island and go to sea for food; and the length of time they remain away is governed probably by the distance they have to go to find fish. Some days they return quite early and on others much later. The manner of flight when returning from one of these food trips is entirely different from that of the ordinary excursions made from the breeding grounds; it is made close to the surface of the water, very direct, one bird following another, and is quite rapid. Sometimes the birds show marked evidences of fatigue.

The numbers of these summer birds at Ipswich I have estimated at various times with considerable care and by various methods. Sometimes, I have measured the sand bar which they covered, or the strip of beach or the length of the line in the water abreast of the beach, and, by allowing a certain number to the square or linear yard, have arrived at a fairly accurate estimate, which I believe in most cases has been below rather than above the mark. The following are some of the dates and the numbers: June 21, 1903, 2,000; July 27, 1903, 2,500; November 20, 1904, 8,000; July 16, 1905, 28,800; July 20, 1907, 5,000; July 12, 1908, 5,000. The large number given for July 16, 1905, was obtained from the measurement of the area occupied by a flock. This was an area of 28,800 square yards, where the birds had stood nearly shoulder to shoulder. Even if there was only one bird in every square yard, the numbers would almost exceed belief.

After the middle of September the ponds about Boston where shooting is forbidden are frequented daily by this bird. The numbers are sometimes so great that the authorities have at times been alarmed lest the waters of the reservoirs be polluted by the droppings of the birds, or by typhoid baccilli, which they fear may be carried on the feet or plumage from sewage on which the gulls feed. I have made especial note of the gulls visiting the Back Bay Basin of Boston, bounded by Boston and Cambridge, and the center of a great area of brick and mortar. For some years past the tides have been excluded and the water is fresh. The gulls do not spend the night here, but come in from the sea, flying high over the houses at sunrise or from time to time during the day. At times companies of many hundreds ride the water. Later in the winter the gulls collect in great flocks on the ice. I have seen several acres of ice here, as well as on Fresh Pond, Cambridge, covered thickly with gulls.

The duration of the visits of the gulls to the fresh-water ponds varies. Sometimes they fly back to the harbor or sea within half an hour, sometimes they tarry much longer; but, as often happens, some are coming and going all day, so it is difficult to say how long the majority remain. However that may be, the ponds are deserted by them at sunset. On one occasion a large flock of gulls remained in Charles River Basin as late as 9 o'clock on a mild December night. It is possible that some food may be obtained on the surface of these bodies of fresh water, but the gulls appear to spend most of their time there gossiping in groups as they float in closely crowded ranks on the surface of the water or stand shoulder to shoulder on the ice.

The subject of the drinking of fresh water has already been discussed above. As the gulls do not spend the night in the small fresh-water ponds on the coast, and as they fly toward the sea at sunset, it is evident that they must spend the night on or near salt water.

One such night chamber—it can not be called a roost—I have found off the beach at Revere, close to Boston. Here in November and December I have seen great companies of these splendid white birds gathering about sunset from a quarter to a third of a mile offshore. Sometimes there are two groups of many hundreds each. Once I saw one that looked like a coral atoll, for it was annular with a calm, open area in the middle. I have seen these birds in a strong offshore wind keep in exactly the same place; so it was evident that each bird, headed up into the wind, must have been paddling hard. This, to our way of thinking, would seem to be a poor manner in which to spend the night—sleep walking with a vengeance. It is possible and indeed probable that later in the evening and during the night, when the beach is free from human intrusion, the birds seek rest on the beach. In fact at sunrise one December day I saw a large flock of herring gulls at Revere, partly on the beach and partly in the water. In the summer at Ipswich the gulls often spend the night on the beach, although they sometimes resort to the marshes and doubtless also sleep on the water. Many of them fly to the small rocky islands, the Salvages, off the end of Cape Ann, and there, secure from human intrusion, spend the night. In some regions herring gulls roost in trees during the night.

It is stated that sometimes herring gulls follow a vessel for food for many miles and even across the Atlantic Ocean. Anthony (1906) states that herring gulls turn back some 25 miles at sea on the Pacific coast.

DISTRIBUTION.

Breeding range.—In North America east to the Atlantic coast. South to central Maine (Penobscot Bay), central New York (Lake Champlain, Hamilton, Herkimer, and Oneida Counties), southern Ontario (Great Lakes), northern Wisconsin (Green Bay), northern Michigan (Sanilac County), central Minnesota (Mille Lacs), southern Manitoba (Shoal Lake), and central British Columbia (Sabine Lake). The western and northern limits are uncertain. Saskatchewan and North Dakota records are confused with *californicus;* breeding records from Forrester and Kodiak Islands, the Alaska Peninsula, Mount McKinley region, and Yukon River are not substantiated by specimens and may refer to *thayeri.* A breeding female has been taken at Lake Tagish, Yukon. For the same reason the northern limits which extend up to southern Ellesmere Land are equally uncertain. The species breeds in Iceland, the British Isles, and in Europe east to the White and Baltic Seas and south to northern France.

Breeding grounds protected in the following national reservations: In Alaska, Forrester Island; in Michigan, Huron Island, and Siskiwit Islands; in Wisconsin, Gravel Island and Green Bay; in Canada, protected on Percé Rock.

Winter range.—From the Great Lakes irregularly and the Gulf of St. Lawrence rarely, southward to Bermuda, the West Indies (Cuba and Jamaica), and the Gulf of Mexico (Florida, Texas, and Yucatan); on the Pacific coast from British Columbia (Puget Sound), south to Mexico (Tres Marias Islands); in Europe from the British Isles south to the Canary Islands and the Mediterranean; and east to the Black and Caspian Seas.

Spring migration.—Dates of early arrival: Prince Edward Island, April 1; Quebec, April 10; Montreal, April 13; Ottawa, March 13; Wisconsin, Madison, March 2; Minnesota, Heron Lake, March 20; Manitoba, Aweme, April 2; Alberta, Edmonton, May 1; Mackenzie, Fort Simpson, May 14; Franklin, Bay of Mercy, May 31, and Prince of Wales Strait, June 7. Dates of late departure: Florida, Clearwater Harbor, May 21; North Carolina, Pea Island, May 3; Maryland, Baltimore, May 28; Rhode Island, Providence, June 12; Massachusetts, Woods Hole, July 4 (average June 11); Louisiana, New Orleans, March 25; Missouri, St. Louis, May 28 (average April 15); Illinois, Chicago, June 15 (average April 23).

Fall migration.—Average dates of arrival: Massachusetts, Woods Hole, August 21; New Jersey, Jersey City, September 21; Georgia, Savannah, November 3; Iowa, Keokuk, October 8. Average dates of departure; Ungava, Fort Chimo, September 18; Labrador, Nakvak, October; Montreal, November 5; Ontario, Ottawa, November 7; Mackenzie, Fort Resolution, September 22; Manitoka, Killarney, October 18.

Egg dates.—Maine: Forty-eight records, May 4 to August 8; twenty-four records, June 12 to 30. Michigan: Twenty-five records, May 21 to June 24; thirteen records, May 27 to June 10. Gulf of St. Lawrence: Nine records, June 7 to 23. Great Britain: Nine records, April 28 to May 26; five records, May 12 to 20.

LARUS THAYERI Brooks.

THAYER'S GULL.

HABITS.

A new species has recently been described by Mr. W. Sprague Brooks (1915), based on the discovery that certain gulls collected by Mr. J. S. Warmbath, in Ellesmere Land in June, 1901, supposed to be Kumlien's gulls, were in reality a distinct and undescribed species. The discovery was made in attempting to identify a gull collected by Mr. Joseph Dixon at Demarcation Point, Alaska, on August 28, 1913. Practically nothing is known about the distribution or life history of this decidedly boreal species.

There are two sets of two eggs each, in Col. John E. Thayer's collection, taken by Mr. Warmbath in Ellesmere Land on June 15, 1910. These, and I believe a few others, were sold as eggs of Kumlien's gull, which they were honestly supposed to be at that time. These eggs are not strikingly different from many other gulls' eggs, though they are rather more pointed than the average; the shape varies from ovate to elongate ovate. The ground color is "dark olive-buff," "buffy brown," or "buffy olive." The markings are similar to those of other large gulls. The four eggs measure 80 by 51.5, 83 by 52, 73 by 49, and 75 to 52 millimeters. There is a set of three eggs in the author's collection, taken by Captain Bernard on Victoria Island, Arctic America, on June 27, 1914. The nest is described as the "usual nest of vegetation on rocks close to the sea." In these three eggs the ground color is, respectively, "deep olive buff," "yellowish glaucous," and "sea foam yellow." All three are quite uniformly and rather thickly covered with small spots of "vinaceous drab" and various shades of dark brown, from "bister" to almost black. In one egg the darkest markings are in scrawls. They measure 67 by 46, 67 by 48.5, and 70.4 by 46.5.

Very little is known about the distribution and habits of Thayer's gull, but, as it is now supposed to be a subspecies of the herring gull, its habits and plumage changes are probably similar to those of the common species.

Mr. Brooks (1915) says of its distribution:

> Though there is no data to determine the range of this species it must be a very boreal form, and perhaps comparatively small in numbers. The Alaskan specimens may have wandered from Ellesmere Land, but it seems reasonable to believe that the bird may inhabit Prince Patrick, Melville, or Bathurst Islands, nearly all this territory being north of 75°.

Dr. Jonathan Dwight (1917) has studied practically all of the specimens of this gull now available, some 25 in all, which he says:

> demonstrate that the supposed new species is nothing more than a geographical race of the herring gull, and should stand as *Larus argentatus thayeri*—Thayer's herring gull. Complete intergradation between the two forms occurs, *argentatus* prevailing south of Hudson Strait and of the northern shores of Hudson Bay, while northward probably throughout the Arctic Archipelago of Canada, *thayeri* seems to be the common form.
>
> Breeding birds of Fort Chimo, Ungava, are *argentatus*, and those of Cape Fullerton, north of Chesterfield Inlet, not quite typical *thayeri*, but farther north and west all the birds are *thayeri*. The localities from which I have seen breeding specimens are Buchanan Bay, Ellesmere Land, Browne Island (south of Cornwallis Island), Kater Point, Coronation Gulf, Bernard Harbor, Dolphin and Union Strait, and Cape Kellett, Banks Island.

Thayer's herring gull probably winters chiefly on the Pacific coast, for I have examined a number of specimens from Barkley Sound, Departure Bay, and Comox, Vancouver Island, British Columbia. I also have an adult female in my own collection taken on the north shore of the St. Lawrence at Tadousac, Quebec, July 26; but this specimen is doubtless a wanderer from the north, for dissection showed it to be a bird past the breeding stage.

DISTRIBUTION.

Breeding range.—Breeding range imperfectly known. Presumably breeding herring gulls from the Artic coast of North America are this form, but it is not possible to verify all records; neither do we know the area where intergradation takes place. Breeding specimens have been examined by Dwight from Buchanan Bay, Ellesmere Land, Browne Island (south of Cornwallis Island), Cape Fullerton, Kater Point, Coronation Gulf, Bernard Harbor, Dolphin and Union Strait, and Cape Kellett, Banks Island. Eggs have been taken at Ellesmere Land (type locality) and Victoria Island.

Winter range.—Probably largely on Pacific coast. Specimens examined by Dwight from Barkley Sound, Departure Bay, and Comox, Vancouver Island, British Columbia.

Migration.—Practically nothing is known regarding the migrations of this gull. It apparently passes north along the Pacific coast at least to southeastern Alaska (Ketchikan, specimen taken); and, lacking negative evidence, we may infer the return is made by the same route.

Casual records.—One was taken at Tadousac, Quebec, July 26.

Egg dates.—Ellesmere Land: Two records, June 15 and July 1. Victoria Island: One record, June 27.

LARUS VEGAE Palmén.

VEGA GULL.

HABITS.

This (so-called) species seems to be nothing more nor less than a dark-backed herring gull, and I doubt very much if it will prove to be more than subspecifically distinct from *Larus argentatus*, if even that. Mr. William H. Kobbé (1902) has presented a very thorough and convincing argument to prove that the two forms intergrade, and suggests that but one species be recognized. The characters on which *Larus vegae* is supposed to stand have been apparently confused with those of *Larus cachinnans*, or are variable and unsatisfactory. For a full discussion of the merits of the case I would refer the readers to Mr. Kobbé's excellent paper.

The distribution of the Vega gull has not been very thoroughly worked out, for our knowledge of the bird life of the region it in-

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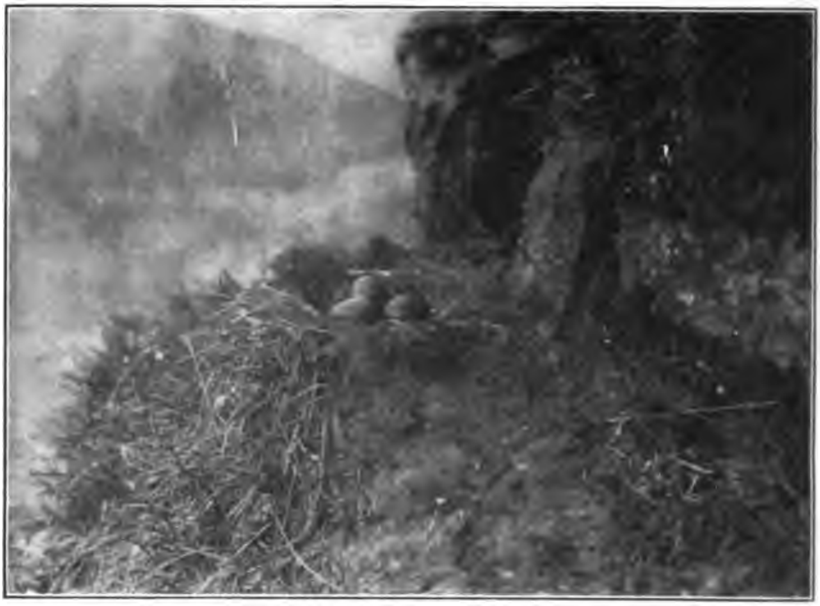
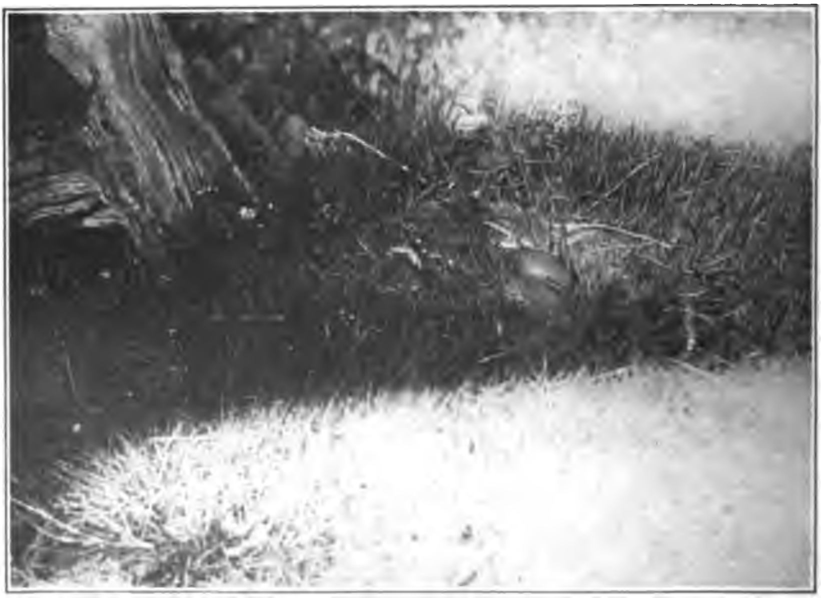


Kolyma Delta, Siberia. J. Koren.



Kolyma Delta, Siberia. J. Koren.

VEGA GULL.

FOR DESCRIPTION SEE PAGE 331.

habits is very meager. Until the limits of its breeding range are well known, and until a large series of specimens have been collected in that region, the correct status of the species can not be determined.

If not identical with the herring gull it is certainly closely related to it, and its habits, so far as we know, are similar. It is therefore fair to assume that its life history closely resembles that of the commoner species, due allowance being made for any differences in environment.

Nesting.—There are three sets of eggs of this species in the author's collection, all of which were taken by Mr. Johan Koren at the mouth of the River Kolyma in northeastern Siberia, where he found it an abundant species along the Arctic coast. Two of these nests were photographed for illustration in this work. The first nest was located on a shelf on a steep bluff 200 feet high, on the bank of the river, where glaucous gulls were also nesting. It contained three eggs, which were nearly ready to hatch on July 10. Another set of three eggs, incubated about 15 days, was taken on July 2. A large nest of moss and straws had been built over the root of a stranded tree trunk, which drifted onto a low, grass-grown islet of the delta. The third set was taken on July 6 and consisted of two eggs, incubated seven days. The nest was made of moss and straws in a bog on a low island of the delta; a colony of six pairs of Vega gulls were breeding on the island.

Eggs.—The above three sets of eggs are so different in coloring that they are worth describing, as representing the usual variations in eggs of this species. In the first set the ground color is "deep olive buff"; the eggs are sparingly spotted over the entire surface with rather small spots of "fuscous," "Vandyke brown," "Dresden brown," and "chestnut brown," over underlying spots and blotches varying from "pale drab gray" to "hair brown." The second set is paler, "olive buff," one egg having a decidedly greenish tinge; this latter egg is heavily and fantastically blotched with dark shades of "chestnut brown" and "Vandyke brown." The third set represents the brownish type; the ground color carries from dull "snuff brown" to dull "tawny olive"; the three eggs are all heavily spotted, chiefly about the larger ends, with confluent spots of "hair brown," "drab," "warm sepia," and dark "Vandyke brown." All of these eggs could be closely matched with similar types of herring gull's eggs, which they resemble in general appearance. The measurements of 30 eggs, in various collections, average 70.4 by 49.5 millimeters; the eggs showing the four extremes measure 77.5 by 50.5, 75.5 by 53.1 and 65 by 47.5 millimeters.

Plumages.—The downy is similar to that of the herring gull, but what specimens I have seen average darker gray in color, less buffy, and are somewhat more heavily spotted with black. Although specimens of this bird are scarce in collections, I have seen enough to convince me that the molts and plumages are similar to those of the herring gull.

Winter.—Our check list states that this species migrates south in winter to Japan, and does not mention any southward migration down the Pacific coast of North America; but Mr. Kobbé (1902) collected a series of herring gulls in San Francisco Bay during December, 1900, and January, March, and April, 1901, some of which might easily be referred to this form. His series, and that of the California Academy of Sciences, show every gradation of color, from the darkest vega to the lightest herring gull. The more one studies such material the less faith one has in *Larus vegae* as a species.

DISTRIBUTION.

Breeding range.—Northeastern Siberia, known to breed on the Kolyma River and its delta; Cape Bolshaja Baranof; Cape Kibera Island; and coast of Tchonkatch (Idligass Island). Taken in summer, and probably breeds on the Siberian coast from the Taimir Peninsula and the Liakoff Islands to Plover Bay and Kamchatka. Alaska breeding records are doubtful.

Winter range.—South along the coasts of Japan and China to Formosa and the Bonin Islands. Records from the Pacific coast of the United States are usually not accepted.

Spring migration.—Northward along the Asiatic coast. China, Formosa Channel, March 9; Japan, Kanagana, March 29; Saghalin Island, June 2 (may breed there).

Fall migration.—Eastward to Norton Sound, Alaska, and then southward along the Asiatic coast. Alaska, Nome, August 31; St. Michael, October 16.

Casual records.—Taken at Laysan Island and Marcus Island in the Pacific Ocean.

Egg dates.—Northeastern Siberia: Eight records, June 4 to July 12; four records, June 24 to July 6.

LARUS CALIFORNICUS Lawrence.

CALIFORNIA GULL.

HABITS.

It has always seemed to me that the above name should have been applied to the western gull, *Larus occidentalis*, the characteristic gull of the California coast, for the subject of this sketch, *Larus californicus*, is essentially a bird of the inland plains. It is common

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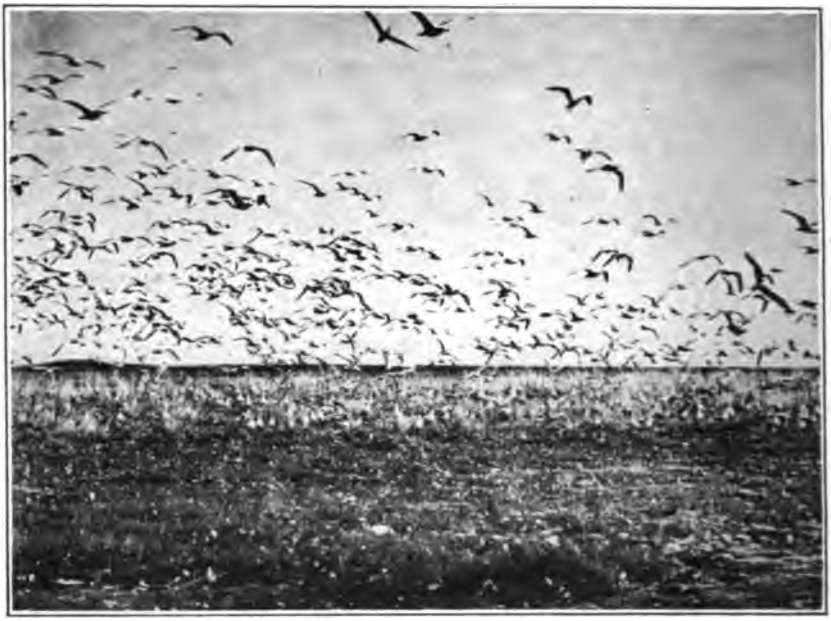
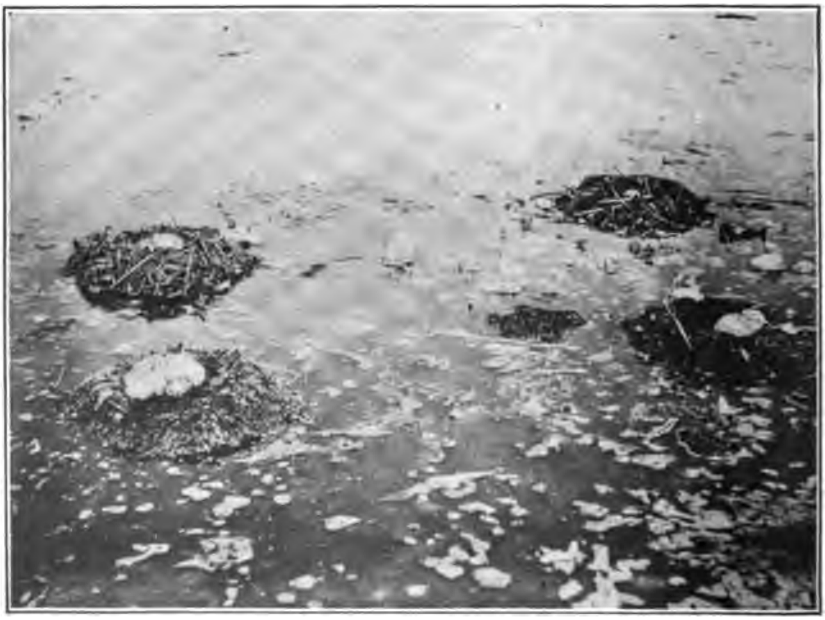


Big Stick Lake, Saskatchewan. A. C. Bent.



Big Stick Lake, Saskatchewan. A. C. Bent.

CALIFORNIA GULL.

FOR DESCRIPTION SEE PAGE 331

enough on the California coast in winter, together with several other species, but it is not known to breed within that State except in the elevated regions east of the Sierras in the northern part of the State. Although we are accustomed to associate gulls with the seashore this species seems to be confined, during the breeding season, to the interior, where it is widely distributed and in many places abundant, particularly in the vicinity of the larger lakes, from northern Utah to the barren grounds on the Arctic coast. The exact limits of its distribution are none too well known, for the casual observer might easily mistake it for the herring gull, which it closely resembles. The ranges of the two species come together at the eastern edge of the Great Plains, and undoubtedly many mistaken identifications have been made where specimens have not been collected. Such was the case at Crane Lake, Saskatchewan, where the herring gull had been reported as breeding abundantly, but where all of the large gulls that we collected during two seasons' work proved to be California gulls, which were very common.

Nesting.—The finest breeding colony of this species that I have ever seen was at Big Stick Lake in that same region, 30 miles north of Maple Creek. On June 14, 1906, our guide drove us out through shallow water to a small island, about 300 yards from the shore. It was a low, flat island, surrounded by gravelly or muddy beaches, largely bare on the higher portions, except for a scattered growth of coarse, dead weeds, but supporting quite a thick growth of long grass on the lower or flatter portion. It may have contained more than 1 acre of land, but certainly not over 2 acres at the most. As we landed a flock of American white pelicans flew off from the farther end and a great cloud of California and ring-billed gulls arose from the center of the island, but we devoted our attention at first to the American avocets, which had flown out to greet us with their yelping notes of protest. Their nests were placed in the short grass near the beach or on the windrows of driftweed which lined the shores. There were not over a dozen pairs in the colony. A small colony of common terns were nesting in the short grass, two nests of spotted sandpipers were found, Wilson's phalaropes were flying about, and specimens of northern phalaropes and semipalmated sandpipers were collected. In the long grass we found a pintail's nest with nine eggs in the process of hatching and five ducks' nests, with apparently fresh eggs, which we took to be baldpates, though we could not identify them with certainty, as the birds were not incubating. On the higher portion of the island, among the tall dead weeds, we found three ducks' nests, referred to hereafter under the American merganser, which we were unable to satisfactorily identify. The California and ring-billed gull colony occupied the whole of the main portion of the island, which was thickly covered with their nests. We could form no accurate idea of their number, as we did not have time to count the nests; but to say that there were at least 1,000 pairs of each species would be a conservative statement. The nests of the ring-billed gulls were chiefly on the higher portion of the island, while those of the California gulls were mostly around the shores and on a bare, flat point, though both species were somewhat intermingled where the two colonies came together. I should say that about half of the eggs had hatched, for we found hundreds of the downy young hiding among the scanty vegetation and saw them swimming out from the shores in large numbers. This island was visited again by the other members of our party July 18–21, 1906, when they found the bird population of the little island increased by a nesting colony of 14 pairs of American white pelicans and 4 pairs of double-crested cormorants.

The California gulls' nests in this colony were well made of dead weeds, rubbish, straw, and feathers. Most of them were on the bare dry ground on the open shores, but many of them were actually in the water; probably these latter were originally built on the dry beach, but recent heavy rains had raised the level of the lake and surrounded them with water; fortunately they had been built high enough to keep the eggs and young dry. The nests varied greatly in size; average nests measured from 14 to 18 inches in diameter. The inner cavity was usually 7 inches wide by 2 inches deep; the outer edges of the nests were built up from 2 to 5 inches above the ground. One extra large nest measured 26 inches in diameter and 7 inches high.

Mr. W. L. Finley (1907) found an interesting colony of California and ring-billed gulls on a tule island in Lower Klamath Lake, Oregon, in May, 1905; I quote from his account of it as follows:

> We were led to the place by watching the course of the small flocks that spread out over the lake in the morning and returned homeward about dusk each evening. From a full mile away, with our field glass, we could see the gulls rising and circling over the low-lying islands. As we rowed nearer the birds came out to meet us, cackling excitedly at the dubious-looking craft approaching so near their homes. They swam about on all sides, curiously following in the wake of our boat. Cormorants flapped along over the surface, pelicans rose heavily from the water, and gulls and terns got thicker and thicker, until when the nose of the boat pushed in at the edge of the island, the air seemed completely filled with a crying, chaotic swarm. We stepped out among the reeds, but had to tread cautiously to keep from breaking eggs or killing young birds. Many youngsters crouched low in their tracks and others scudded off in all directions.
>
> Although there were at least 500 pairs of gulls nesting so close together, yet housekeeping was in no sense a communal matter. The nests were within 2 or 3 feet of each other, but each pair of gulls had its own home spot, and the invasion of that place by any other gull was the challenge for a fight.

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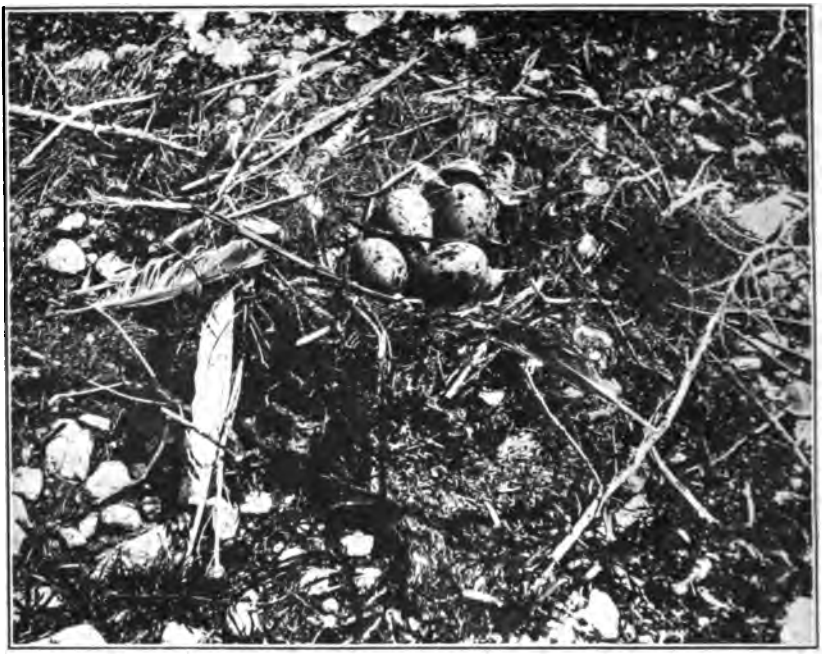
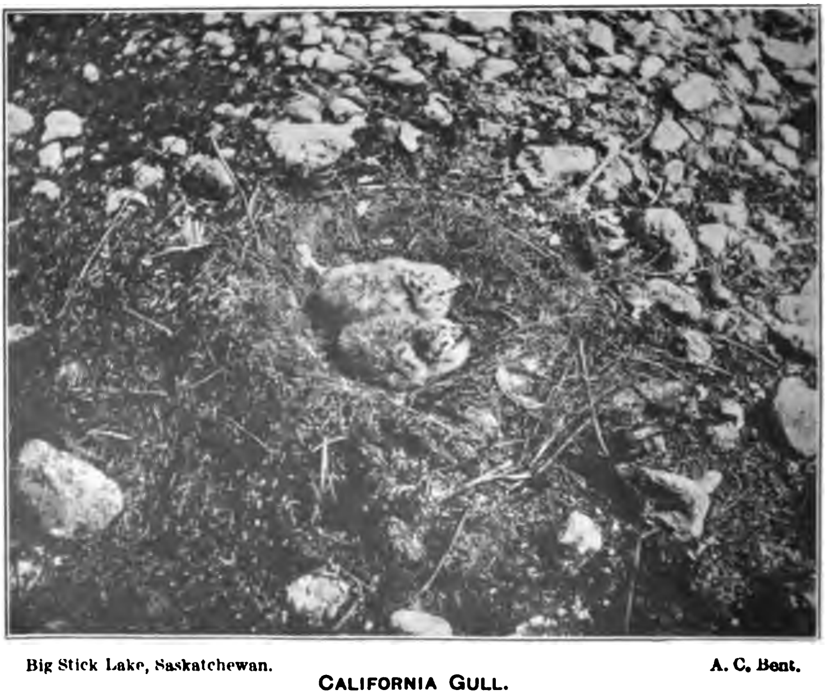


Big Stick Lake, Saskatchewan. A. C. Bent.



Big Stick Lake, Saskatchewan. A. C. Bent.

CALIFORNIA GULL.

FOR DESCRIPTION SEE PAGE 331.

> Several times we were the excited spectators of fights that were going on just outside our tent. I watched one old hen, who was very angry because she could not find her chicks. As one of her neighbors lit near she grabbed the tail of the intruder and gave it a sharp jerk. At that both birds grasped each other by the bill and a lively set-to followed. They pulled and tugged till suddenly the old hen let go and grabbed her opponent by the neck and began shaking and hanging on with all the tenacity of a bull pup, till the intruder got enough and departed, leaving the victor with a mouthful of feathers.

Mr. Oliver Davie (1889) says of the nests of the California gull:

> The nests of this species are made on the ground or built on rocks, and sometimes where the birds are breeding in vast colonies the nests are placed on stunted sage or greasewood bushes. They are built of sticks, grass, and a few feathers.

Eggs.—As with most water birds, only one brood is raised in a season. The usual set consists of three eggs, but two are often considered sufficient; four eggs are laid occasionally, and five have been reported. The eggs are similar to other gulls' eggs, but they are usually handsomer and often more boldly marked with striking colors. The shell is thin and lusterless. The shape varies from short ovate to elongate ovate. It is usually more pointed than in other gulls' eggs, and is sometimes nearly ovate pyriform.

The ground color shows a variety of shades from "Saccardo's umber" or "buffy brown," in the darker specimens, to "light drab," "smoke gray," or "olive buff," in the lighter specimens, which are much commoner. The commonest types of eggs are spotted more or less evenly with rather small spots of irregular sizes and shapes, but many of them are boldly marked with large spots and blotches; often lighter and brighter shades of brown seem to be overlaid on spots of darker brown or gray, producing handsome effects. Some eggs are oddly decorated with fantastic scrawls and irregular lines, such as are seen on murres' eggs. These markings are generally in the darker and richer shades of brown, such as "bone brown," "olive brown," "warm sepia," and "Vandyke brown." Nearly all eggs show underlying spots of "light violet gray," or similar colors. The measurements of 50 eggs in the United States National Museum average 67.5 by 45.5 millimeters; the eggs showing the four extremes measure **71.5** by 47.5, 69 by **50.5**, **57.5** by 41, and 65.5 by **40.5** millimeters.

Young.—I have no data on the period of incubation, which is probably about the same as with other large gulls. Probably both sexes incubate. The young are quite precocial; after a few days in the nest, they learn to run about and hide among the stones or under the vegetation near their nests. They are good swimmers and, even when very small, will take to the water readily and swim away until driven back by their parents, who keep a careful watch over them. Mr. Finley (1907) says of their behaviors at this time:

> I soon discovered that their greatest anxiety seemed to be to keep their children crouching low in the nest so they would not run away and get lost in the crowd. I saw one young gull start to run off through the reeds, but he hadn't gone a yard before the mother dived at him with a blow that sent him rolling. He got up dazed and started off in a new direction, but she rapped him again on the head till he was glad to crouch down in the dry reeds.
>
> The parents seemed to recognize their own chicks largely by location. Several times I saw old birds pounce upon youngsters that were running about and beat them unmercifully. It seemed to be as much the duty of a gull mother to beat her neighbor's children if they didn't stay home as to whip her own if they moved out of the nest, but often this would lead to a rough and tumble fight among the old birds. Sometimes a young gull would start to swim off in the water, but it never went far before it was pounced upon and driven back shoreward.

Plumages.—The young bird, when first hatched, is covered with thick, soft down of plain, light colors to match its surroundings, "light buff" to "cartridge buff," brightest on the head and breast; the upper parts and throat are clouded or variegated with light grayish, and the head is sparingly spotted with dull black. These colors fade out to a dirty grayish white as the bird grows older. The juvenal plumage is much like that of the herring gull; the head and underparts are dark and mottled, the dusky markings prevailing; the upper parts are boldly mottled, each feather being broadly edged with buffy white and centrally dusky. The first winter plumage, which is acquired early in the fall by a partial molt of the body feathers, is everywhere mottled with dusky, the underparts, especially the neck and breast, being tinged with cinnamon; the tail, which in the young ring-billed gull is basally gray, and the primaries are uniform brownish black and the bill is dark. This plumage is worn for nearly a year or until the first postnuptial molt, when the bird is a year old. This molt is complete, producing the second winter plumage, which is more or less mottled with dusky, except on the mantle, which now becomes more or less clear "gull gray." The new primaries are nearly black, but with little or no white tips; the tail is white at the base, becoming dusky near the tip. The bill becomes yellow at the base, but the outer half remains dusky. A partial prenuptial molt occurs during the latter part of the winter or early spring in both old and young birds, producing whiter heads and necks.

A nearly adult winter plumage is acquired at the second postnuptial molt, when the bird is a little over 2 years old. At this molt, which is complete, the black primaries with limited white tips and the pure white tail, often subterminally marked with dusky, are acquired; the bill becomes wholly yellow. Winter adults have elongated dusky markings on the crown and a necklace of dusky spots on the hind neck, which are lost at the partial prenuptial molt before the next breeding season. The bright chrome yellow of the upper mandible and the vermilion of the lower mandible are characteristic of the breeding season. Subsequent seasonal molts of the adult are merely repetitions of the complete postnuptial in the summer and the partial prenuptial molt in early spring, involving only the head and neck.

Food.—The feeding habits of the California gull make it one of the most useful of birds to the agriculturist of the western plains, where it makes its summer home. Rev. S. H. Goodwin (1904) says of its habits in Utah:

> I have watched them for hours as they circled about the newly plowed field, or followed close behind the plowman, as blackbirds do in some localities, or sunned themselves on the ridges of the furrows after a hearty meal of worms. I have studied them as they fared up and down the river in search of dead fish and other garbage, or assembled in countless numbers in some retired, quiet slough where they rent the air with their harsh, discordant cries and demoniac laughter, or sailed on graceful wing in rising circles till lost in the deep blue of heaven.

Mr. Dutcher (1905) publishes the following interesting letter from Mr. John E. Cox, of the Utah Board of Agriculture:

> Gulls go all over the State for insects, the greatest number visiting the beet fields, where they keep down the crickets, grasshoppers, cutworms, etc. They took a new diet this summer. Some alfalfa fields were so badly honeycombed with mice holes and runs that it was impossible to irrigate them, and they were plowed up, mostly for beet culture. When the water was turned into the irrigation ditches the mice were forced out of their holes, and the gulls then caught them. They became so perfect in their work that they kept abreast of the head of the water and picked up every mouse that appeared. When gorged with victims they would vomit them up in piles on the ditch bank and recommence their feeding. Gulls are sacred in Utah, and are so tame that oftentimes they may be caught by hand as they follow the plow so closely.

Dr. A. K. Fisher (1893) reports that a specimen of this species, shot at Owens Lake, California, "on December 28, had its craw full of duck meat and feathers, and from the actions of its associates when a duck was shot it was evident that they prey upon such game, since the lake affords little other food." During the two seasons that I spent in Saskatchewan we saw the California and ring-billed gulls almost daily visiting the garbage heaps on the outskirts of Maple Creek, where they found a good supply of food to vary their natural diet of insects and other animal food picked up on the prairies and about the lakes. During their winter sojourn on the Pacific coast they follow the example of others of their kind and become largely scavengers about the harbors. They also, probably, feed on fish to some extent.

Behavior.—Mr. Finley (1907) refers to their powers of flight as follows:

> These gulls are masters in the air. I have watched by the hour birds similar to these following along in the wake of a steamer, but had never before had such chances with a camera. Often they poise, resting apparently motionless on outstretched wings. It is a difficult feat. A small bird can not do it. A sparrow hawk can only poise by the rapid beating of his wings. The gull seems to hang perfectly still; yet there is never an instant when the wings and tail are not constantly adjusted to meet the different air currents; just as in shooting the rapids in a canoe the paddle must be adjusted every moment to meet the different eddies, currents, and whirlpools, and it is never the same in two different instants. A gull by the perfect adjustment of its body, without a single flap of the wings, makes headway straight in the teeth of the wind. I saw one retain a perfect equilibrium in a stiff breeze and at the same time reach forward and scratch his ear.

Mr. Dawson (1909) pays the following tribute to their prowess on the wing:

> Graceful, effortless, untiring, but above all mysterious, is that power of propulsion by which the bird moves forward into the teeth of the gale; indeed, is advanced all the more certainly and freely when the wind is strong. From the deck of a steamer making 15 miles an hour against a 15-knot breeze, I once stretched my hand toward a soaring gull. He lay suspended in mid-air without the flutter of a feather, while the air rushed past him at the rate of 30 miles an hour; and he maintained the same relative position to my hand, at 5 or 6 feet, for about a minute. When he tired of the game, he shot forward. And again, there was not in the motion the slightest perceptible effort of propulsion, but only a slightly sharper inclination of the body and wings downward. We see clearly how it must be, yet we can not understand it. The gull is a kite and gravity the string. The bird is a continually falling body, and the wind is continually preventing the catastrophe. Yes, we see it—but then, gravity isn't a string, you know; and so why doesn't the wind take the kite along with it? Well, there you are; and not even Hamilton, who discovered quaternions, could have given the mathematics of it.

My knowledge of the vocal powers of the California gull is confined to what I heard and noted on its breeding grounds, where its vocabulary was limited. The ordinary cry was a soft, low "kow, kow, kow," or "kuk, kuk, kuk," much like the notes of other gulls. When the birds became much excited or alarmed they indulged in shrill, sharp, piercing cries. Gulls are usually silent birds, but while feeding, quarreling, or showing active emotions, they have a variety of notes to express their feelings or to communicate their ideas to their fellows, all of which seem to be understood.

California gulls seems to be quiet, gentle, harmless birds, and I have no evidence to show that they do any appreciable damage to the various species with which they are associated on their breeding grounds, though they do occasionally steal a few eggs from unprotected nests. They have been found nesting in colonies with ring-billed gulls, Caspian terns, white pelicans, double-crested cormorants, and great blue herons. So far as I know they have no formidable enemies among birds and are not much molested by man. They select for their breeding grounds islands in remote lakes far from the haunts of man, where they are probably safe until the encroachments of civilization drive them out. They are not suspicious or wild; in fact, they are much tamer than most gulls, but they do not seem to be fond of human society.

Winter.—The fall migration is westward to the Pacific coast or southwestward to the large inland lakes of the Southwestern States and Mexico, where they spend the winter, associating on the coast with various other species of gulls.

DISTRIBUTION.

Breeding range.—Western North America. East to Great Slave Lake and northeastern North Dakota (Stump and Devils Lake). South to northwestern Wyoming (Yellowstone Lake), northern Utah (Great Salt Lake), western Nevada (Pyramid Lake), and northeastern California (Eagle Lake). West to central southern Oregon (Klamath Lakes) and central British Columbia. North to northern Mackenzie (Anderson River region). Occurs in summer from Washington (Bellingham Bay) to southeastern Alaska (Ketchikan), but not known to breed there.

Breeding grounds protected in the following national reservations: In California, Clear Lake; in Nevada, Anaho Island (Pyramid Lake); in Oregon, Klamath and Malheur Lakes; in Wyoming, Yellowstone National Park.

Winter range.—Pacific coast, from southern British Columbia southward to southwestern Mexico (San Mateo), and from northern Utah (Great Salt Lake) southward to the Gulf of California; rarely east to the coast of Texas.

Spring migration.—Northeastward to the interior. Early dates of arrival: North Dakota, Devils Lake, April 24; British Columbia, Okanagan Lake, April 11. Late dates of departure: Lower California, San José del Cabo, May 17; California, Monterey, May 19.

Fall migration.—Southwestward toward the coast. Early dates of arrival: British Columbia, Chilliwack, August 26; Washington, Seattle, August 31; Oregon, Netarts Bay, September 8; California, Monterey, August 21 to October 9; Lower California, Magdalena Bay, November 24. Late dates of departure: Mackenzie, Hay River, November 5; Kansas, Reno County, October 20.

Casual records.—Has been recorded in the Hawaiian Islands (Bryan) and in Japan (Seebohm).

Egg dates.—Utah and Nevada: Fifty-six records, May 8 to June 26; twenty-eight records, May 18 to 20. North Dakota and Saskatchewan: Twelve records, June 4 to 22. California: Six records, May 18 to 25.

LARUS DELAWARENSIS Ord.

RING-BILLED GULL.

HABITS.

Audubon (1840) referred to this species as "The Common American Gull," a title which would hardly be warranted to-day, although, with the possible exception of the herring gull, it is the most widely distributed and most universally common of any of the large gulls. In Audubon's time it was probably more widely distributed and certainly more abundant in some localities than it is now; he refers to its breeding on "several islands between Boston and Eastport, another close to Grand Manan at the entrance of the Bay of Fundy, the great Gannet Rock of the Gulf of St. Lawrence, and certain rocky isles in the deep bays on the coast of Labrador." I have visited all of these localities without finding or hearing of any breeding colonies of ring-billed gulls, and I can not find anything in the published records to indicate that they have bred at any of these places in recent years, except a few shifting colonies near Cape Whittle in southern Labrador, found by Mr. M. Abbott Frazar (1887) in 1884, and one found by Dr. Charles W. Townsend, referred to below. The ring-billed gull yields readily to persecution, is easily driven away from its breeding grounds, and seems to prefer to breed in remote unsettled regions, far from the haunts of man. It could never survive the egging depredations which the herring gull has withstood successfully; hence its breeding range has been gradually curtailed as the country has become settled. Although its former breeding range was nearly as extensive as that of the herring gull, it is now mainly restricted to the interior, in the lakes of the prairies and plains of the Northern States and Canada, where it far outnumbers the herring gull and is still *the common gull.* Here it is probably holding its own except where civilization is driving it out. In North Dakota in 1901, in Saskatchewan in 1905 and 1906, and in Manitoba in 1913 we saw it almost daily about nearly all the lakes we visited and we found numerous breeding colonies. Dr. P. L. Hatch (1892) stated that they had become much more numerous in Minnesota through a gradual increase since 1857, being "extensively distributed over the lacustrine regions of the Commonwealth, breeding in all places adapted to their habits."

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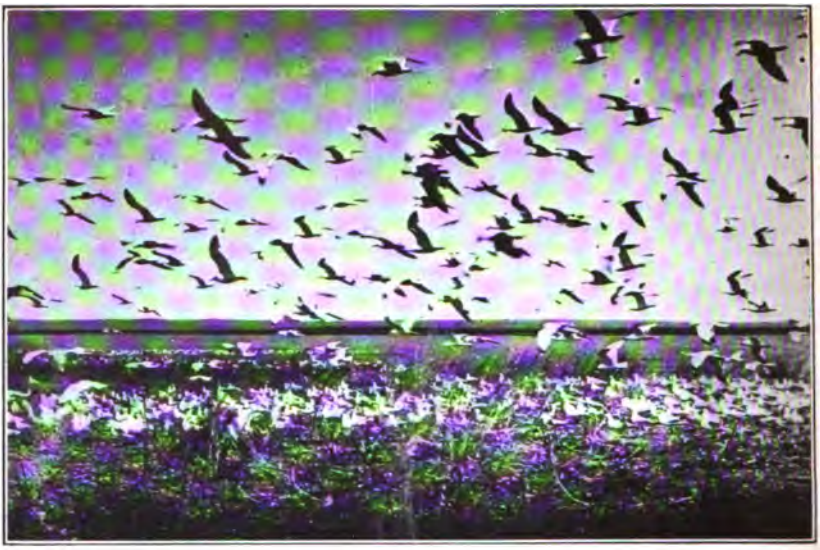
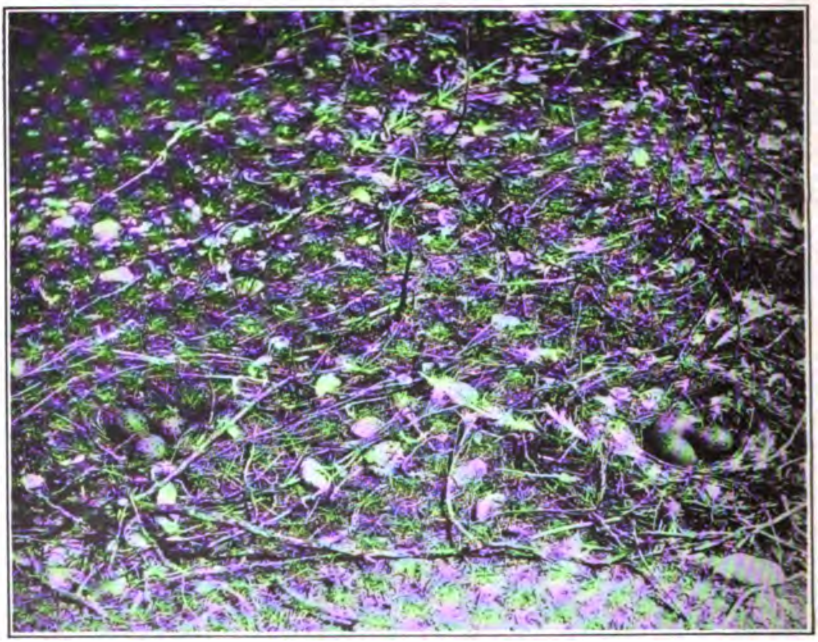


Big Stick Lake, Saskatchewan. A. C. Bent.



Big Stick Lake, Saskatchewan. A. C. Bent.

RING-BILLED GULL.

FOR DESCRIPTION SEE PAGE 331

Courtship.—According to Audubon (1840) mating takes place before the birds reach their breeding grounds. He says:

> When spring has fairly commenced, our common gulls assemble in parties of hundreds, and alight on mud flats or sandy beaches, in out eastern estuaries and bays. For awhile they regularly resort to these places, which to the gulls are what the scratching or tooting grounds are to the pinnated grouse. The male gulls, however, although somewhat pugnacious, and not very inveterate in their quarrels, making up by clamor for the deficiency of prowess in their tournaments. The males bow to the females with swollen throats, and walk round them with many odd gesticulations. As soon as the birds are paired they give up their animosities, and for the rest of the season live together on the best terms. After a few weeks spent in these preparatory pleasures, the flocks take to wing, and betake themselves to their breeding places.

Nesting.—My first experience with the nesting habits of the ring-billed gull was on "the enchanted isles" of Stump Lake, North Dakota, three small islands in a western arm of the lake, now included in the Stump Lake Reservation. On May 31, 1901, and again on June 15, 1901, I visited these interesting islands, with Mr. Herbert K. Job (1898) who had previously described and named them. Two of the islands contained breeding colonies of ring-billed gulls, consisting of about 100 pairs each; one held a colony of about 75 pairs of double-crested cormorants; and one a large colony of common terns. All of them offered suitable nesting sites for various species of ducks, of which we found no less than 40 nests on June 15. Certainly the bird population of these little islands warranted Mr. Job's title. The gulls' nests were placed upon the ground along the upper edges of the beaches and among the rocks and bowlders which were scattered all over the islands. They were made of dried grasses and weeds, sometimes of small sticks; were lined with finer grasses and were often decorated with feathers. On May 31 all the nests contained eggs, many of which had been incubated a week or 10 days; on June 15 not over one quarter of the eggs had hatched and many of them still held incomplete sets.

One of the most interesting gull colonies I have ever found was on a small island in Big Stick Lake, Saskatchewan, on June 14, 1906, where large numbers of this and the preceding species were breeding, together with a number of other water birds. I have already described this colony more fully in my account of the nesting habits of the California gull. The nests of the ring-billed gulls were on the higher portions of the island, somewhat apart from those of the larger species, but mingled with them to some extent. The nests were made of dead weeds, straws, rubbish, and feathers; they measured from 10 to 12 inches in diameter, and the inner cavity was about 9 inches across and 2 inches deep. Most of the nests were in open situations, but some were partially hidden among the rocks and low bushes. About half of the eggs had hatched, and the downy young were running about or hiding.

Ring-billed gulls were common at Lake Winnipegosis, Manitoba, in 1913. We saw them almost daily and examined several breeding colonies. They were on small rocky islets or reefs, where bowlders had been piled up a few feet above high water and a little soil had accumulated about them. On one very small reef, not over 25 yards long, I counted 10 nests of ring-billed gulls and 45 nests of double-crested cormorants. The islet was thickly covered with nests of the common tern, of which I estimated that there were about a thousand pairs. Another thickly populated island, but slightly larger, was visited on June 19. It was similar to the other reefs—an accumulation of bowlders, with sandy or stony shores and some soil in the center, sparsely overgrown with nettles. A cloud of gulls and terns were hovering over it, which I estimated to contain about 100 pairs of ring-billed gulls and 500 pairs of common terns. There was also a small colony of double-crested cormorants nesting on the rocks at one end. The nests of the gulls and terns were closely intermingled, sometimes three or four nests within one square yard, showing that the two species were living in apparent harmony. The gulls' nests were very poorly built affairs, the poorest I had ever seen, consisting in many cases of mere hollows lined with a few sticks and straws. Some of them were more elaborate and some were prettily decorated with feathers or lined with green weeds or leaves. Most of the nests contained three eggs, but many of them only two. No young were seen.

Audubon (1840) found them breeding on the Gannet Rock, early in June, "on the shelves toward the summit, along with the guillemots, while the kittiwakes had secured their nests far below." This undoubtedly refers to Bird Rock in the Gulf of St. Lawrence, where none of this species have been found breeding in recent years.

Dr. Charles W. Townsend writes me:

> On July 16, 1915, I found a breeding colony of ring-billed gulls on Gull Island near Sealnet Point or Point au Maurier, on the Canadian Labrador coast. The island is close to the shore, is composed of granitic rock with sparse vegetation of grass and low herbs, and is some 10 acres in extent. On the highest ground about 200 pairs of ring-billed gulls had their nests. These nests were composed of moss, sprigs of curlew-berry vine, dried grass, and dried-weed stalks. The nests were 12 inches in outside diameter, 6 or 7 inside diameter, generally very thin, but sometimes built up to a height of 3 or 4 inches. They were placed on the bare rock or among the grass. A few herring gulls, eiders, razor-billed auks, and black guillemots were also nesting on the island.

Mr. William L. Finley (1907) describes a large colony of California and ring-billed gulls which he found breeding on a marshy island of floating tules in Klamath Lake, Oregon, which is a decided departure from their usual habit of nesting on solid ground.

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'Prince William Sound, Alaska. G. G. Cantwell.

Big Stick Lake, Saskatchewan. A. C. Bent.

RING-BILLED GULL.

FOR DESCRIPTION SEE PAGE 332.

Mr. George G. Cantwell has sent me a photograph of a remarkable nest of a ring-billed gull which he found at Prince William Sound, Alaska, in June, 1912. His notes state that the nest was "made of usual material, but unique in the matter of situation, placed in the crown of a dwarf spruce, that grew to the height of about 4 feet above the surface of a small rock, upon which it had taken root. The rock set in an open bay of the salt water, about one-half a mile from shore. On other near-by islands a colony of Arctic terns were nesting, and on the bars of a stream on the near-by mainland other ring-billed gulls had nests. This was the only nest noted in the trees there, or on any other occasion."

Eggs.—The ring-billed gull normally raises but one brood, and the full set usually consists of three eggs; often only two eggs are laid, and sets of four are very rare. The eggs are subject to the usual variations in gulls' eggs. In shape they are usually ovate or short ovate; the shell is smooth, thin, and almost lusterless. The ground color varies from "Brussel's brown" or "snuff brown" to "pinkish buff" or "cartridge buff" in the commoner types of eggs; in the greener types of eggs, which are rarer, the ground color varies from "deep olive buff" to "pale olive buff," or in some cases to "yellowish glaucous," which makes the egg look much greener than it really is. The prevailing types of eggs show the usual markings of gulls' eggs—spots and blotches of various sizes and shapes irregularly distributed; some eggs are finely speckled all over; in some the markings are confluent into a ring; and some are handsomely decorated with irregular scrawls, splashes, or blotches. Nearly all eggs show underlying spots or blotches of various shades of "quaker drab," lavender or "mouse gray." These markings are very faint in the lighter types. The heavier and darker markings are made up of various shades of brown, often several shades on the same egg overlapping each other as if superimposed; these vary from "blackish brown" or "fuscous black" to "burnt umber," "russet," or "Dresden brown." Often the darkest markings are on the lightest colored eggs, making strong contrasts. The measurements of 40 eggs in the United States National Museum and the author's collections average 59.3 by 42.3 millimeters; the eggs showing the four extremes measure **64.5** by 42.5, 59.5 by **44.5, 54** by 40.5, and 60.5 by **40** millimeters.

Young.—The period of incubation is about 21 days. The young remain in the nest for a few days, but soon learn to run about and hide among the rocks or under the vegetation near their nests. They learn to swim at an early age, and may often be seen swimming out from the shores of their island home when disturbed. They are carefully guarded by their anxious parents and driven back to dry land as soon as the dangerous intruder has departed. They seem to appreciate the value of their protective coloring, and will remain hidden until forced to run, when they become very lively. They are fed by their parents until able to fly and forage for themselves.

Plumages.—The downy young have at least two distinct color phases, both of which are often found in the same nest. In the gray phase the upper parts are "smoke gray" or "pale smoke gray"; in the buffy phase the upper parts are "pinkish buff" or "vinaceous buff." They are lighter below and almost white on the breast; they are distinctly spotted with "hair brown" or "sepia" on the head and neck, and more faintly mottled with the same color on the back.

The juvenal plumage is not fully acquired until the young bird is about fully grown, the down disappearing last on the chest and thighs. The upper parts are heavily and boldly mottled; each feather of the back, scapulars, lesser wing coverts, and tertials is centrally dusky, broadly tipped, and margined with "pinkish buff," most conspicuously on the scapulars. The greater wing coverts are largely "gull gray," becoming dusky near the tips, and some are tipped or edged with buffy. The primaries are mostly black, with narrow white tips; the tail is largely "gull gray," somewhat mottled, and with a broad subterminal band of dusky, tipped with white or buffy white. The tail is never wholly dusky, as in the young California gull, a good diagnostic character. The under parts are largely white; the crown and breast are heavily mottled with dusky, and the sides are barred with the same. The bill is dusky, with the inner half of the lower mandible light yellowish.

Except for a molt of some of the body plumage, the first winter plumage is a continuation of the juvenal; the buffy edgings fade out to white and wear away; many new feathers, partially "gull gray" with dusky markings, come in on the back; and the dusky markings fade and wear away or are replaced by white on the breast and head during the winter. A partial prenuptial molt increases the amount of white on the head and under parts.

A complete postnuptial molt produces the second winter plumage, in which the back is mainly or wholly "gull gray," the feathers narrowly edged with whitish, and the greater wing-coverts are largely the same; the lesser wing-coverts are still mottled with dusky; there is much dusky in the tertials and secondaries, and the primaries are plain brownish black. The tail is whiter basally, but has a broad subterminal dusky band. The head and neck are heavily streaked and spotted with dusky, but the under parts are mainly white. The inner half of the bill is yellowish and the outer half black. The partial prenuptial molt produces pure white under parts and nearly a pure white head, with a clear "gull gray" back.

At the next complete molt, the second postnuptial, when the bird is 2 years old, the fully adult plumage is perhaps assumed by some birds; but many, probably a decided majority, still retain signs of immaturity during the third year. The new primaries in such birds are black, but they have only a faint suggestion of the subterminal white spot on the outer primary or none at all; undoubtedly these spots increase in size with the successive molts. There is more or less dusky in the tertials, and the tail has the black subterminal band more or less clearly indicated. The remainder of the plumage and the bill is now like the adult. Such birds would become fully adult at the age of 3 years. I have one bird in my series which is quite heavily mottled with dusky on the breast, but is otherwise fully adult.

The complete postnuptial molt of both adults and young occurs mainly in August and September, but I have seen the molt beginning as early as June. The partial prenuptial molt, involving the contour feathers only, occurs mainly in March. The winter adult is similar to the spring adult, except for a few narrow streaks of dusky on the crown and hind neck; these are less in evidence in older birds.

Food.—The feeding habits of this species make it as fully beneficial as any of the gulls. Throughout the agricultural regions of the western plains, where it is more abundant, it is often seen in the spring following the plow, picking up worms, grubs, grasshoppers, and other insects. It also does effective work by feeding on field mice and other small rodents. Dr. J. A. Allen, according to Baird, Brewer, and Ridgway (1884), states in regard to their feeding habits in Salt Lake Valley:

> At the period of his visit these birds spent much of their time on the sand bars of Weber River, and at certain hours of the day rose in the air to feast on the grasshoppers, on which they seemed at this time almost wholly to subsist. The stomachs of those gulls that were killed were not only filled with grasshoppers, but some birds had stuffed themselves so full that these could be seen when the birds opened their mouths. And it was a curious fact that the gulls captured the grasshoppers in the air and not by walking over the ground, as they have been said to do. Sailing around in broad circles, as though soaring merely for pleasure, the birds seized the flying grasshoppers as easily, if not as gracefully, as a swallow while in rapid flight secures its prey of smaller insects.

I have seen ring-billed gulls hovering over a flock of feeding red-breasted mergansers and darting down at them as they rose to the surface. They were apparently trying to rob them of or make them drop some of the fish they had caught.

We found this and the foregoing species frequenting regularly the garbage dumps on the outskirts of the prairie towns and acting as scavengers along the shores of the lakes in Saskatchewan. On the seacoasts it does its part with other species in cleaning up the floating refuse in our harbors, and gathers in large numbers where garbage is regularly dumped, feasting on the miscellaneous diet it finds. It does considerable damage on its breeding grounds by destroying the eggs of other species associated with it. I have seen a party of ring-billed gulls break and suck nearly every egg in a colony of double-crested cormorants when the latter had been kept off their nests for an hour or two; but I doubt if they would have dared to molest them if the cormorants had not been driven away by our presence. It occasionally robs the nests of the avocet, but it does not seem to molest the nests of the common tern, with which it is intimately associated; and I have never known of its disturbing any of the ducks which nest on its breeding grounds. Probably the terns are able to defend their eggs and the duck's nests are too well hidden.

Behavior.—The flight of the ring-billed gull is not markedly different from that of the other larger gulls; it is light and graceful as well as strong and long sustained. It can poise stationary in the air when facing a good breeze without moving its wings except to adjust them to the changing air currents, and can even sail along against the wind in the same manner. It is often so poised while looking for food on the water, but if the wind conditions are not favorable it is obliged to hover. When food is discovered it either plunges straight downward or floats down more slowly in a spiral curve, and picks up its food without wetting its plumage. When alighting on the water its wings are held high above it as it drops lightly down with dangling feet. It swims gracefully and buoyantly, sitting lightly on the surface. It rises neatly from the water. It has no very distinctive field marks and closely resembles several other species. but it is somewhat smaller than the California gull and very much smaller than the herring gull; it also has a lighter gray mantle and less white in its black wing tips. The black ring in its bill is not always in evidence and can not be seen at any distance.

Its notes are similar to those of other closely related gulls, but they are on a higher key than those of the two larger species referred to above. When alarmed or when its breeding grounds are invaded it utters a shrill, piercing note of protest—*kree, kreeee*—like the cry of a hawk, but when its excitement has somewhat subsided this note is softened and modified and the subdued *kow, kow kow* notes are often heard from a flock of gulls floating overhead. It is often noisy while feeding, while a cloud of hovering gulls show their excitement by a chorus of loud squealing notes and shrill screams. While pursuing its ordinary vocations it is usually silent, except for an occasional soft, mellow *kowk.*

The ring-billed gull is a highly gregarious species, both on its breeding grounds and in its winter resorts, congregating in large flocks of its own species and associating with a variety of other species, with all of whom it seems to live in perfect harmony. Except for its cowardly, egg-robbing habits, it is a gentle and harmless creature. It seems to have no enemies from which it has much to fear except man. Its universal habit of nesting on islands saves it from the attacks of predatory animals.

Winter.—During the winter months much of its time is spent at sea following the coastwise vessels in company with other gulls in search of such morsels as it may pick up, hovering in clouds about our harbors where garbage is dumped, or resting in large flocks on sand bars or mud flats at low tide—a season of rest and recreation, with freedom to roam where it will.

DISTRIBUTION.

Breeding range.—Mainly in southern Canada. East to Hamilton Inlet and southern Labrador (Point au Maurier). South to northern New York (Adirondacks, casually), central Ontario (Muskoka Lake, Georgian Bay, etc.), Lakes Huron and Michigan (formerly), Wisconsin (Green Bay, formerly), northern North Dakota (Devil's Lake region), and northern Utah (Great Salt Lake). West to central southern Oregon (Klamath Lakes) British Columbia (Shuswap Lake), and southern Alaska (Prince William Sound). North to central Mackenzie (Great Slave Lake), eastern Keewatin (north of Fort Churchill), and James Bay (Fort George).

Breeding grounds protected in the following national reservations: In Oregon, Malheur Lake; in North Dakota, Stump Lake.

Winter range.—From Massachusetts (irregularly) southward along the Atlantic coast to Florida and Cuba; and along the Gulf Coast to Mexico (Tehuantepec); west to the Pacific coasts of Mexico and the United States, southward to Oaxaca, and northward to British Columbia; in the interior north to Colorado (Barr Lakes), more rarely Idaho (Fort Sherman), Montana (Lewiston), and the Great Lakes (Chicago and Detroit).

Spring migration.—Northward along Atlantic coast and in the interior; northeastward from the Pacific coast. Early dates of arrival: Connecticut, Saybrook, March 8; Newfoundland, April 19; Missouri, St. Louis, March 7; Iowa, Keokuk, March 8, and Storm Lake, March 15; South Dakota, Sioux Falls, March 19, and Vermilion, March 31; North Dakota, Devils Lake, average April 16, earliest April 11; southern Manitoba, average April 25, earliest April 21; Mackenzie, Pelican River, May 9. Late dates of departure: Florida, Big Gasparilla Pass, May 22; North Carolina, Pea Island, May 10; New Jersey, Atlantic City, June 20; Texas, Corpus Christi, April 12; Louisiana, New Orleans, April 28; Missouri, Kansas City, May 3; Wisconsin, Madison, May 17.

Fall migration.—Eastward, southward, and westward to the coasts. Early dates of arrival: Massachusetts, Chatham, September 7; South Carolina, Charleston, September 26; Florida, Fernandina, September 16; Mississippi, Bay St. Louis, October 10; California, Los Angeles County, September 17. Late dates of departure: Gulf of St. Lawrence, Anticosti Island, September 18; Massachusetts, Woods Hole, November 17; North Dakota, Harrisburg, October 17; Colorado, Denver, November 12; Utah, Provo, November 30.

Casual records.—Accidental in Hawaiian Islands (one taken in winter 1901) and in Bermuda (January 1, 1849).

Egg dates.—North Dakota: Forty-eight records, May 9 to June 22; twenty-four records, May 31 to June 15. Saskatchewan and Manitoba: Seventeen records, June 4 to 23. Quebec Labrador: Ten records, June 20 to 30.

LARUS BRACHYRHYNCHUS Richardson.

SHORT-BILLED GULL.

HABITS.

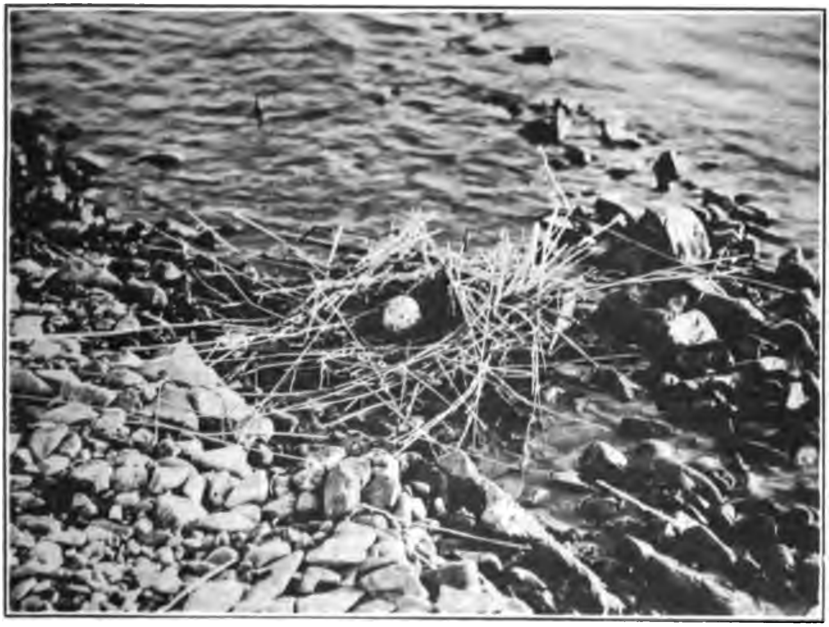
The North American counterpart of the common mew gull of Europe is so closely related to it that many ornithologists question the specific distinction of the two species. The characters on which they are separated are very slight and not very constant; there is so much individual variation in both forms that they seem to intergrade and may yet be proven to be no more than subspecies. The short-billed gull is a widely distributed and common species throughout the whole of the interior of Alaska and the northern portions of the northwest territories. It is a marsh-loving species and frequents all the flat marshy country of the coast and interior, as well as much of the wooded region in the vicinity of lakes, ponds, and streams.

Spring.—Mr. Lucien M. Turner (1886) says:

> The short-billed gull arrives at St. Michael according to the openness of the season. It comes in few numbers as soon as large cracks are made in the ice. This may be early as the 1st of May or as late as the 25th. The season of 1874 was unusually open. Upon our arrival at St. Michael, on May 25, hundreds of these gulls were flying over the bay. In the course of a few days they became less, so that by the middle of June only few pairs were seen. In later years they were not abundant at any time, though the breaking up of the ice was accompanied with visits of numbers of them.

Turner's failure to note them after the middle of June was doubtless due to their being busy with family duties. Early in June they forsake the outer bays and scatter over the tundra where they construct their nests. Often their breeding places are several miles back from the coast, which they visit less frequently until after the young are on the wing.

Lake Athabaska, Saskatchewan. F. Harper.



Lake Athabaska, Saskatchewan. F. Harper.

SHORT-BILLED GULL.

FOR DESCRIPTION SEE PAGE 332.

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St. Michael, Alaska. F. S. Hersey.

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F. S. Hersey.

Nesting.—Mr. Hersey found a nest of this gull near St. Michael, Alaska, on June 19, 1915, containing an egg on the point of hatching and a young bird only a few hours' old. The nest was on a small islet in a tundra pond; the islet was only a few yards long and about 2 feet above the level of the water. The nest was merely a hollow in the ground, about 8 inches in diameter and 3½ inches deep, scantily lined with dry grass; it was located in the center and on the highest part of the islet. His notes say:

> When about one-eighth of a mile away one of the parents flew about above me screaming loudly. As I drew nearer the bird came lower down and when within 75 yards of the nest she flew directly over it and hovered. While photographing it both birds darted repeatedly at my head, and when I finally left they followed me for half a mile.

Dr. Joseph Grinnell (1900) made some interesting observations on the nesting habits of this species on the Kowak delta, Alaska. He writes:

> The lakes which the short-billed gulls mostly frequented were usually surrounded by spruce trees, which in the delta are more low and scrubby than farther in the interior. I had in vain searched for the gulls' nests on small bare islets in the lakes and on grassy points, such as the gulls with which I was previously familiar would be likely to select for nesting sites. Although I failed to find any sign of nests, still the birds, by their uneasy actions, intimated that there must be eggs or young somewhere. Finally on the 16th of June I determined to discover the secret, and, armed with patience, selected a secluded hiding place among some scrub spruces near a lake, yet where I had a good view of it. Two pairs of short-billed gulls kept flying about above me for a long time, occasionally alighting on the tops of the spruces surrounding the lake. I kept track of each of the four gulls as best I could, and finally saw one settle close down on the bushy top of a tree on the other side of the lake. Then it dawned on me that the nests might be in trees. I took my bearings on the tree, and started around the lake. Before I had nearly reached the vicinity I was met by the gulls, one of which began to dive at me again and again. It would fly high above me and then swoop down past my head with a shrill, startling scream. Just as the bird passed me it would void a limy mass of faeces, and with such disagreeable precision that I was soon streaked with white. On climbing the spruce, which was about 12 feet tall, I discovered the nest. It was almost completely hidden from below by the flat, bushy top of the spruce on which it was placed. The nest was a shapeless mass of slender twigs and hay, 9 inches across on top. There was scarcely any depression and I found the shells of two of the eggs broken on the ground beneath, probably pitched out by a severe wind of the day before. The single egg secured was considerably incubated. After I left the nest the gulls followed me a long ways, dashing down at me at intervals as before described. I found several more nests by carefully examining the bushy topped spruces around lakes, but none contained eggs. Probably the jaegers which I saw in the vicinity were responsible for this. One of the nests was only about 7 feet above the water on a leaning spruce at the edge of a pond. The rest of the nests were from 10 to 20 feet above the ground in spruces growing nearest the water's edge.

Mr. Roderick McFarlane (1891), who collected many sets of eggs in the Anderson River region, says:

> Its nest is usually a small cavity in the sand by the side of a stream or a sheet of water; but it also frequently builds on a stump or tree, and in such cases dry twigs, hay, and mosses, are used in its construction. The parents do their utmost to drive away intruders.

Eggs.—The short-billed gull ordinarily lays three eggs, but often only two. They are ovate or short ovate in shape; usually the former. The ground color varies from "Saccardo's umber" or "Isabella color" to "olive buff." The eggs are spotted and blotched evenly or irregularly or in a wreath near the larger end, with the darker shades of brown, such as "bone brown," "bister," "sepia," or "snuff brown"; also with various shades of "brownish drab." Sometimes the eggs are finely scrawled. The measurements of 40 eggs, in the United States National Museum average 57 by 41 millimeters; the eggs showing the four extremes measure **63** by 41.5, 58.5 by **43, 50.5** by 40.5, and 51.5 by **37** millimeters.

Plumages.—The young, when first hatched, is well covered with a warm coat of soft, thick down, "pale drab-gray" to "pale smoke-gray" on the upper parts, sides, and throat; "pale pinkish buff" on the breast and belly; and tinged with the latter color on the sides of the head and neck. The frontal and loral region is clear black. The sides of the head and neck are boldly and clearly spotted with black in a very distinct pattern, the spots coalescing into an indistinct Y on the crown; an irregular W on the occiput; a large, distinct crescent on the cervix; and a small crescent on the throat. The remainder of the upper parts are heavily but less distinctly mottled with duller black, becoming grayer posteriorly. The under parts are unspotted.

I have not seen any specimens showing the development of the first plumage from the downy stage, but I have a good series of young birds collected in August. This plumage shows considerable individual variation, but is always more or less heavily mottled both above and below. Often the throat, and sometimes the belly, is nearly or quite immaculate white; sometimes the entire under parts, below the throat, as well as the neck and head, are uniform "drab-gray," or "vinaceous gray," and always these parts are heavily clouded with these colors. The feathers of the back, scapulars, and wing-coverts are centrally dusky and broadly edged with pale-grayish buff; the primaries are uniformly dusky; the rectrices are basally gray, somewhat mottled, with nearly the terminal half dusky, and white-tipped. From this plumage the progress toward maturity begins early and continues all through the first year, by fading, wear, and molt. The "gull gray" of the mantle sometimes begins to appear in November, and by April or May this color predominates on the back. The white increases on the head and underparts, so that in the spring some individuals are largely white below; but in most cases the bellies are more or less clouded with dusky. The wings and tail also fade out to nearly white in the lighter areas.

A complete postnuptial molt produces the second winter plumage, which is worn for one year. This much resembles the adult plumage. The head and neck are heavily mottled with dusky in the fall, but become pure white by wear and molt during the winter and spring. The back is wholly "gull gray," and the wings are largely so, but there is some dusky mottling on the bend of the wing. The tail is largely white, but there is a subterminal black band, varying in extent in different individuals. The primaries are brownish black, not deep black as in adults, with a large white spot near the tip of the outer and sometimes a smaller one on the second.

At the second postnuptial molt, which is complete, the adult winter plumage is usually assumed at the age of about 2 years. This is the same as the adult nuptial plumage, except that the head is streaked, the throat is spotted, and the neck is clouded with dusky, all of which disappears at the partial prenuptial molt. The white spaces and gray wedges in the primaries are not always fully developed in third-year birds, but become more pronounced at succeeding molts. Other traces of immaturity are often retained during the third winter.

Food.—Mr. Turner (1886) gives the following account of the feeding habits of the short-billed gull:

> At Atkha Island, in the early part of August, 1879, a small species of fish (*Mallotus villosus*) was thrown up by the waves onto the beach. These fish cast their spawn in the sand and is covered by the next wave. The gulls of this species follow the wake of these fishes, and during the spawning season devour many thousands of them. At Amchitka Island I observed this species frequenting the beach at low tide and securing the sea urchins, which occur plentifully. The birds seize the prey, carry it several yards into the air and then drop it on the rocks, or, as it frequently happens, into the little pools left by the receding tide. These pools are of variable depth, but when of not more than a few inches deep, the bird again took the object to drop it, perhaps into the same place; evidently not with the intention of washing any objectionable matter from its surface, but simply from the fact that the bird had not yet learned to calculate the law of falling bodies, yet when the shellfish was dropped on the rocks and broken open the bird greedily devoured the well-filled ovaries. These gulls and the ravens frequently carry the shells far to the inland and there break them open with their beaks. The old shells may be frequently found on a knoll of ground or tuft of grass.

Doctor Nelson (1887) says that "along the coast of Bering Sea they feed upon sticklebacks and other small fry which abound in the sluggish streams and lakes." Mr. E. A. Preble (1908) found that "three specimens collected May 12 had been feeding on water beetles (*Dytiscus dauricus*)." Mr. Hersey frequently saw them feeding on the garbage dumps near St. Michael. During the fall and winter they forage regularly with the larger gulls about the harbors and shores where garbage and other offal is to be found.

Behavior.—In its flight and swimming habits the short-billed gull does not differ materially from the larger species. Mr. Hersey observed that the adults show considerable curiosity, following the intruder about over the tundra, and that the young are even tamer, circling about within 15 or 20 feet for several minutes at a time, turning the head from side to side and watching intently, but making no sound.

Doctor Grinnell (1900) remarks:

> Their usual notes are louder and sharper than those of the glaucous gulls and remind one of the bark of a terrier.

Doctor Nelson (1887) says:

> They show considerable curiosity upon the appearance of an intruder, and very frequently follow one for some distance, uttering a sharp, querulous "kwew," kwew." When one or more are shot the others circle about a few times, but show very little solicitude over the fate of their companions. From the 18th to 25th of July most of the young are able to fly, and early in August old and young gather along the courses of streams or near the larger lakes. From this time on many of the birds are found also about low spits and mud flats along the coast. The young frequently follow boats for long distances on a stream or near shore, and they are so unsuspicious that they may almost be knocked down with a paddle. The old birds pass through the fall moult the latter half of August, and by the middle of September they are in the new dress and gradually disappear from the north, until by the end of this month they become rare. In September they fraternize more commonly with the kittiwake than at any other season in the bays and along the coast.

Mr. Hersey's notes, however, state:

> When the young are well grown and able to fly they join the flocks of glaucous gulls feeding about the bays and tide creeks. They appear to prefer the society of this species to that of their own kind, as I have repeatedly observed. Flocks of adult short-billed gulls have been met with continually without seeing any young, but practically every flock of glaucous will contain at least two young short bills. Generally two are found together, probably a family.

Winter.—The fall migration carries the short-billed gulls down the Pacific coast to their winter range from Puget Sound to southern California, where they are fairly common all winter, associated with Pacific kittiwakes, glaucous-winged, western, herring, and Bonaparte's gulls—a mixed party of seacoast scavengers. Mr. W. L. Dawson (1909) gives the following account of this species on the coast of Washington in winter:

> A certain childish innocence and simplicity appear to distinguish these birds from the more sophisticated herrings and glaucous-wings. They are the small fry of the great gull companies which throng our borders in winter, allowed to

share, indeed, when Petro dumps a rich load of restaurant waste, but expected to take a grumbling back seat when the supply of food is more limited. One may see at a glance that they are not fitted for competition. Their bills are not only shorter, but much more delicately proportioned than those of the other gulls; while their gabbling, duck-like notes oppose a mild alto to the screams and high trumpetings of their larger congeners.

Gulls of this and allied species are quick to appreciate the advantages of protected areas. Along the water front or near steamers, where shooting would not be allowed, they become very bold. Short-bills, however, do not stand about on palings, piles, and roofs, as do the glaucous-wings, but rest, instead, almost exclusively on the water. Thus, if one attempts to bait the gulls with an offering of bread laid on the wharf rail, the larger gulls will begin to line the neighboring rails and posts, craning their necks hungrily or snatching exposed fragments; but the short-bills will settle upon the water and draw near to the piling below, content to catch such crumbs as fall from the high-set table.

DISTRIBUTION.

Breeding range.—Northwestern North America. East to Mackenzie Valley. South to northern Saskatchewan and Alberta (Athabasca Lake), northern British Columbia (Atlin Lake) and southern Alaska (Glacier Bay and Prince William Sound). West to the Bering Sea coast of Alaska (Nushagak and Norton Sound) and St. Lawrence Island. North to northern Alaska (Kowak River and Cape Lisburne), Herschel and Baillie Islands, and northern Mackenzie (Fort Anderson).

Winter range.—Pacific coast of the United States from the southern end of Vancouver Island and the Puget Sound region southward to southern California (San Diego).

Spring migration.—Northward along the coast and eastward to the interior. Early dates of arrival: British Columbia, Queen Charlotte Sound, April 6; Alaska, Admiralty Island, April 24, Mount McKinley, May 10, St. Michael, May 11, and Kowak River, May 15; Mackenzie, Fort Simpson, May 8, and Great Bear Lake, May 23.

Fall migration.—The reverse of the spring. Early dates of arrival: British Columbia, Chillawack, August 26; Oregon, Scio, September 21; California, Berkeley, October 9, Monterey, October 29, Ventura, November 26 and San Diego, December 11. Late dates of departure: Alaska, Icy Cape, July 30, Cape Nome, August 28, Camden Bay, September 8, St. Michael, September 23, Unalaska, October 1, and Sitka region, October 7; Mackenzie, Lake Hardisty, August 25.

Casual records.—Has been taken in Quebec City (Dionne), in Wyoming (Wind River Mountains, August 28, 1893), and in Kurile Islands (February).

Egg dates.—Athabasca, Mackenzie region: Nineteen records, May 28 to July 5; ten records, June 15 to 21. Alaska: Thirteen records, May 30 to July 5; seven records, June 16 to 20.

LARUS CANUS Linnaeus.

MEW GULL.

HABITS.

Contributed by Charles Wendell Townsend.

This gull, also called sea-mew or common gull, is a native of northern Europe and Asia, and is given a doubtful place in the Check List of the American Ornithologists' Union by the statement that it is "accidental in Labrador (?)". In Birds of Labrador, by Townsend and Allen (1907), the whole matter was carefully investigated, and as no new light has been thrown, it seems worth while to quote the results here:

> The following is from Audubon's Labrador "Journal," under date of June 18, 1833. "John & Co. found an island (near Little Mecattina) with upwards of 200 nests of the *Larus canus*, all with eggs, but not a young hatched. The nests were placed on the bare rock; formed of seaweed, about 6 inches in diameter within and a foot without; some were much thicker and larger than others; in many instances only a foot apart, in others a greater distance was found. The eggs are much smaller than those of *Larus marinus*." Elliott Coues adds the following note after *Larus canus:* "Common gull.—This record raises an interesting question, which can hardly be settled satisfactorily. *Larus canus*, the common gull of Europe, is given by various authors in Audubon's time, besides himself, as a bird of the Atlantic Coast of North America, from Labrador southward. But it is not known as such to ornithologists of the present day." In his Notes on the Ornithology of Labrador (in Proc. Acad. Nat. Sci. Phila., 1861, p. 246) Dr. Coues gives *L. delawarensis*, the ring-billed gull, three specimens of which he procured at Henley Harbor, August 21, 1860. These were birds of the year, and one of them, afterwards sent to England, was identified by Mr. Howard Saunders as *L. canus* (P. Z. S., 1877, p. 178; Cat. B. Brit. Mus., XXV, 1896, p. 281). This would seem to bear out Audubon's Journal; but the "common American gull" of his published works is the one he calls *L. zonorhynchus* (i. e., *L. delawarensis*); and on page 155 of the Birds of Am., 8vo ed., he gives the very incident here narrated in his journal as pertaining to the latter species. The probabilities are that, notwithstanding Dr. Coues's finding of the supposed *L. canus* in Labrador, the whole Audubonian record really belongs to *L. delawarensis*.

The mew gull, although common during the migrations on the English coasts, does not breed south of the Scottish border, according to Saunders (1889), who says that its trivial name, "common gull," has led to many errors. In Scotland, the Hebrides, Orkneys, and Shetland it breeds in abundance, and a few breeding haunts are to be found in Ireland. It also breeds in Norway and Sweden and northern Russia and Siberia. In winter, according to Saunders (1889), "it occurs on the shores, lakes, and rivers of the rest of Europe down to the Mediterranean; also on the African side of the latter as far as the Suez Canal."

Nesting.—This gull breeds in colonies on the shores of lakes or of the sea not far above the water. It is especially fond of grassy islands, and often makes its nest among the wrack thrown up on the shore. It has been found in Norway breeding on the shores of lakes 4,000 feet above the sea. Instances are on record where it has occupied the deserted nest of a crow in bushes or trees. The nest is generally rather large, and is made up of seaweed, grass, weed stalks, bits of heather, etc.

Eggs—Three eggs constitute a set. They are olive brown to straw color in color, or even pale blue or light green, spotted and streaked with brown and black. The average measurements are 2.25 by 1.50 inches.

Young.—The downy young are of a yellowish gray color, lighter on the face, throat, and abdomen. The upper parts and throat are marked with large blackish spots. One of these spots always touches the base of the upper mandible.

Behavior.—Saunders (1889) says:

> As a rule this gull does not go far from land, and owing to its being one of the first to seek the shore on the approach of coarse weather, it has been made the subject of many rhymes and poetical allusions. It feeds on small fish, mollusks, crustaceans, etc., and may frequently be seen picking up grubs on the furrows in company with rooks, while it will sometimes eat grain.

Macgillivray (1852) says:

> The fields having been cleared of their produce and partially plowed, to prepare them for another crop, the "sea mews," deserting the coasts, appear in large flocks, which find subsistence in picking up the worms and larvae that have been exposed. These flocks may be met with here and there at long intervals in all the agricultural districts, not only in the neighborhood of the sea, but in the parts most remote from it. Although they are most numerous in stormy weather, it is not the tempest alone that induces them to advance inland; for in the finest days of winter and spring they attend upon the plow, or search the grass fields as assiduously as at any other time.

This gull also picks up floating offal from the surface of the water, and catches small fish, such as sand eels and young herring. From the beaches and rocks on the shore it picks up crustacea, mollusks, echinoderms, etc. In general habits it closely resembles the ring-billed gull. Its flight is light and buoyant and it dips down to the water gracefully, rarely if ever plunging below the surface. Its cry is shrill and somewhat harsh.

DISTRIBUTION.

Breeding range.—Northern Europe and Asia. East to northeastern Siberia (Gichiga and Marcova, Anadyr District) and Kamchatka. South to latitude 53° N. West to the British Isles. North to the Arctic coast of Europe and Asia.

Winter range.—From the British Isles south to the Canary Islands, the Mediterranean Sea, northern Africa, the Nile Valley, and the Persian Gulf, and on the Asiatic side to Japan and China.

Casual records.—Has been taken once in North America (Henley Harbor, Labrador), a young bird of doubtful identity. Records from California refer to other species.

Egg dates.—Great Britain: Twenty-two records, May 6 to July 18; eleven records, May 16 to June 1.

LARUS HEERMANNI Cassin.

HEERMANN'S GULL.

HABITS.

Among the mixed flocks of large gulls which frequent the beaches of southern California we frequently see a few and sometimes many smaller gulls conspicuous by their dark color and long legs. Some seem to be wholly black or dark brown; these are the young birds, which are present more or less all the year round. Others, with conspicuous white heads, are the adults; these are absent during the later part of the spring and early summer, while on their breeding grounds farther south. The species is very well marked and entirely unlike any other species of *Larus*. It has even been placed by some writers in another genus, *Blasipus*, together with two or three other species found in other parts of the Pacific Ocean, which its general appearance seems to warrant. It is different from other gulls also in its migrations, being the only one of our gulls which migrates southward to breed and northward again to spend the fall and winter.

Courtship.—Mr. Wilmot W. Brown jr., has given us the only account we have of the courtship of this species. He was fortunate enough to arrive on the Island of Ildefonso, in the Gulf of California, early enough to see it. I quote from his notes, published by Col. John E. Thayer (1911), as follows:

> When I first arrived (March 24) there were an immense number of birds. The males were constantly seen fluttering over the females on the ground, near their nests; but no eggs were laid until April 2. It seems they spend some time in courtship before settling down to their matrimonial duties. The female when in passion emits a peculiar squeaky sound as she coaxes the male by squatting down and going through the most ludicrous motions. I have also seen a pair holding on to each other's bills, a kind of tug-of-war affair; then they would back away and go through a suggestion of a dance, but all the time talking to each other in low love tones. The appearance of a duck-hawk would send them all flying to sea. They would return, however, very quickly.
>
> On the southeastern end of the island, facing the sea, there is a large semicircular shaped depression, which covers about 5 acres. It is quite level on the bottom and covered with gravel, with here and there blocks of lava scattered about.

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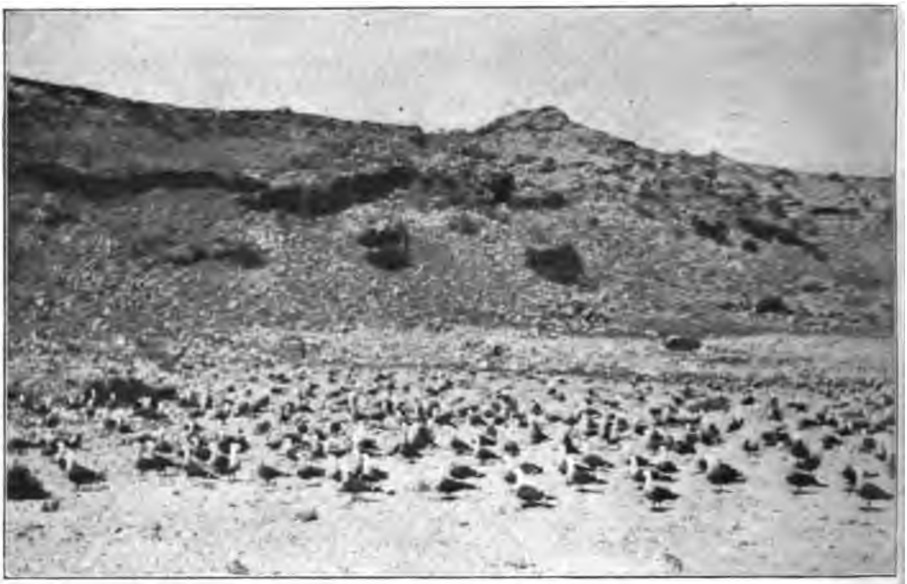
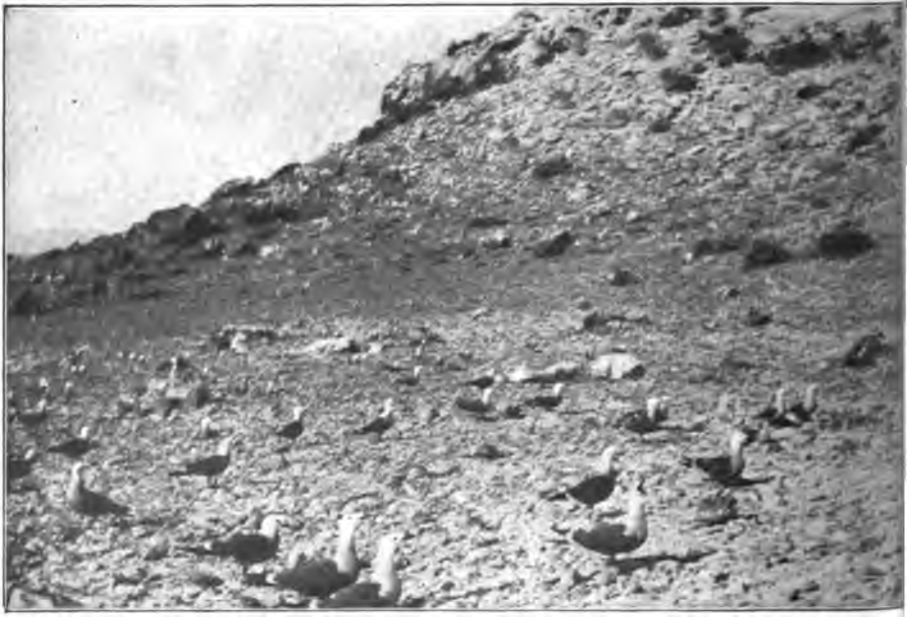


Ildefonso Island, Lower California. W. W. Brown.



Ildefonso Island, Lower California. **W. W. Brown.**

HEERMANN'S GULL.

FOR DESCRIPTION SEE PAGE 332.

It is well protected from the northwest wind, which prevails here in March and April. At the time I arrived on the island immense numbers of these gulls had congregated. They literally covered the ground. They were so occupied in their love making that they paid very little attention to us. Their cries deadened the cries of all the other birds, and they kept it up all through the night.

Nesting.—The nest in all cases was simply a well-formed depression in the ground with no lining whatsoever. There must have been over 15,000 Heermann gulls nesting on this island.

Mr. Pingree I. Osburn (1909) found a colony of Heermann's gulls breeding "on a remote rock off the coast of the State of Jalisco, Mexico, in about the parallel 18° N." He writes:

The rock was about 25 feet high and 50 by 150 feet across, with a plat of coarse bunch grass a foot high in the center, and along the edge a barren strip of white rock, broken up here and there with crevices and bowlders. The rock contained 31 pairs of breeding birds, ascertained after a careful count. The birds in the nesting grounds behaved in much the same manner as the western gulls, but were tamer, swooping down within a foot of my head and alighting nearby while I was photographing in the colony.

A cursory survey of the rock showed that it was steep on all sides. The birds undoubtedly preferred the level ground for a nesting place, as only one set was found on this cliff. The nests were located usually between bowlders or nestled down in the bunch grass in the center of the rock. Those in the grass were usually well made of sticks, dry grass, and weeds, and sometimes with a slight lining of feathers. They were much better made and more compact than those of the western gull. Several nests in my collection still show their original shape and construction; also retain the strong odor peculiar to these birds on their nesting grounds. A few sets were found with almost no nest; simply a cup-shaped cavity scantily lined with shells and a stick or two. The nests were well scattered about over the rock, no close grouping being evident. The measurements of the nests average, in inches—outside width, 10; depth, 2½. No other species of gull was seen in company with the Heermann gulls, and none within hundreds of miles of these islands.

The first visit to the rock was on April 11. At this time about one-third of the eggs were heavily incubated. The remainder were in all the lesser stages. The sets contain two and three eggs in about equal numbers, with a possible majority of three.

Eggs.—The eggs show the greatest variation in color. The general ground color is pearl gray with a very slight creamy tinge. In some the ground color is ashy gray and in others light bluish gray. All the eggs are spotted and blotched, the markings showing no particular rule for location at one end or the other. They have faint lavender spots, which are covered with smaller but more distinct spots of grayish brown, umber, grayish blue, and dark lavender. They are very rarely scratched with fine lines, but occasionally the spots and splashes show a trend to a lengthwise direction. A few examples also have faint wreaths about the large end. Where this occurs the area inside the wreath is usually void of heavy markings and decorated only with faint irregular lavender spots. In extreme examples the eggs range from one egg, which is indistinctly specked with cinnamon brown and marked evenly with faint lavender, to an egg which has a ground color twice as deep as the egg just mentioned, and heavily splotched with dark olive and dark lavender. There is also one set of three which is especially unlike the others, in that the eggs are smaller and more elongated, both ends of the egg being almost identical in shape. This set is differently marked also. The spots are dingy and not clearly defined as in the remainder of the series. In all, they are the handsomest eggs of any species of this genus which I have ever seen.

The measurements of 52 eggs, in various collections, average 59.2 by 42.7 millimeters; the eggs showing the four extremes measure **64** by **45** and **53** by **37.5** millimeters.

Plumages.—The downy young is covered with short, thick down, which on the head, throat, breast and flanks is "pinkish buff" or "pale pinkish buff," becoming paler toward the belly, which is pure white. The back is grayish white, mottled with dusky, and there are a few dusky spots on the top of the head. I have seen no specimens illustrating the change into the first plumage.

Coues (1903) says of the young of the year:

> Entire plumage deep sooty or fuliginous-blackish; all the feathers, but especially those of back and upper wing coverts, edged with grayish-white. Primaries and secondaries black, as in adults, with only traces of white tips on the former. Tail black, very narrowly tipped with dull white.

Birds that I have seen in what I call the juvenal plumage have the greater and lesser wing-coverts and the feather edgings "olive brown." They apparently change, by a partial and gradual molt, from this into the first winter plumage between June and October, the wing-coverts becoming grayer, the light edgings of the feathers disappearing by wear, and more or less white appearing on the throat and chin. During the first spring the wholly black bill of the young bird becomes dull reddish on the basal half. This plumage is worn until the next summer, the first postnuptial molt, if it may be so called, beginning in June. This complete molt produces the second winter plumage, which is similar to the first winter, except that the primaries and rectrices are blacker and very narrowly edged with pale brown; the upper tail-coverts are more slaty; the head and nape are clear slate-black, the mantle is darker slate-black and the bill is practically like the adult.

A year later the young bird assumes a third winter plumage, similar to that of the winter adult, except that the dark mottling on the head is more extensive, including the whole head and throat, and all the colors are darker. The white predominates on the throat, but the rest of the head is very dark. The wings and tail of the adult plumage are assumed, but there is great individual variation in the extent of the white tips of the primaries and the rectrices, though the latter are always broadly tipped with white. At the next prenuptial molt, which is only partial, including mainly the head and neck, young birds become indistinguishable from adults; they are then nearly 3 years old.

The postnuptial molt of adults, which is complete, occurs mainly in July and August, though it is often prolonged into September. Adults in the fall may be distinguished from young birds by being somewhat lighter in color both above and below, with the gray of the body plumage shading off gradually into the white of the head and neck; in young birds this change is much more abrupt. The head and neck are much whiter in old birds, with much less dusky mottling, confined principally to the top and sides of the head. The partial prenuptial molt begins in December, and by January or February the pure white head of the nuptial plumage has been acquired. The white tips of the primaries wear away partially or wholly before spring, and the white tips of the rectrices also disappear before the postnuptial molt.

Food.—Although the food of Heermann's gull consists largely of fish and other sea food, which it obtains offshore, it also indulges freely in a great variety of other foods and does its part as a scavenger along the shores and on the beaches with the other gulls, where it does not seem to be at all fastidious as to its diet. Dr. George Suckley (1860), however, says:

> This species, unlike the ring-billed and many other gulls, does not seem to be fond of feeding on the shores and bare flats, but is almost always (in that vicinity at least) found on the kelp beds floating in the deep water some distance from shore. Whether they are attracted to these kelp beds by the hopes of finding small shellfish in the upturned and netlike roots of such plants as, detached from their fastenings on the bottom, have become entangled together and with others in situ, or because these floating islands afford a convenient resting place where they can rest to a great extent secure from their enemies of the land, I can not say; but presume that the presence of a supply of food must be a great inducement.

Mr. A. W. Anthony (1906) describes their method of catching fish as follows:

> When herring are swimming in compact schools near the surface both Heermann's and western gulls secure them by approaching the school from behind and flying near the surface of the water, making repeated, quick dips into the school. The fish seek safety in the depths the instant anything occurs to alarm them, but soon return to the surface, so that the gulls by stalking them from the rear are enabled to approach quite near before the fish are alarmed. As soon as the limits of the school have been passed the gull, rising higher in the air, returns by a wide circuit and again passes over the school from the rear. As the fish all swim in one direction, in a compact mass, these tactics afford the gulls a decided advantage, which seems to be thoroughly understood. I think that the Heermann's gull secures about one out of five fish that are snapped at and the western half as many. Royal tern and the other gulls employ these same methods but to a less extent.

They have also been found to feed on shrimps and other crustaceans and mollusca.

Behavior.—I have never noticed anything peculiar or distinctive in the flight of this species, which is very much like that of the larger gulls; nor can I find anything of interest in regard to it in print. The species is, of course, easily recognized in life by its very distinctive colors in all plumages.

Mr. Anthony (1906) refers to its voice as a "whining catlike cry" while attacking the pelicans to rob them of their food. Mr. Osburn (1909) says:

> Their cry was an oft-repeated "cow-auk," "cow-eek," given when high in the air, and a rapid guttural "caw-ca-ca-ca" when hovering near the nest.

Mr. W. L. Dawson (1909) writes that, if disturbed in their summer loafing places, "they suddenly take to wing and fill the air with low-pitched mellow cries of strange quality and sweetness, as they make off to some distant rendezvous."

Though not so much of an egg thief as some other gulls, it is somewhat of a pilferer of food and quite bold in attacking species larger than itself which are too stupid to resist its persecution. Mr. Anthony (1906) has given us the following interesting account of its method of robbing the pelicans:

> Heermann's gull is by far the most active and successful in catching small fish from the surface; but as a rule will seldom attempt to catch his own dinner if there are any pelicans among the delegates to the convention. There are times when the herring are so thick and so driven from below by the large fish that the pelicans will sit on the surface and snap them up without plunging, as is their normal method, from a height of from 10 to 30 feet in the air. If the fish are swimming the deep plunge often carries the bird completely under the surface, and when a second later he bobs up like a cork he is sure of finding at least one, often two Heermann's gulls expectantly awaiting the result. If there are two they will usually take up stations on each side and but a foot in front of the pelican, which still holds its huge bill and pouch under the water. It may be that the pelican does not yet know the result of his efforts, for in plunging the pouch is used as a dip net and, if nothing else, it is full of water, which is allowed to escape past the loosely closed mandibles until, perhaps 5 or 10 seconds after the bird made his plunge, a flutter is seen in the pouch, announcing one or more struggling victims. It is still an open question, however, whether they will be eaten by the gull or the pelican, and the latter is seemingly well aware that a herring in the gullet is worth two in the pouch, for it will often wait several seconds for a favorable opportunity for disposing of the catch; the gulls meantime constantly uttering their nasal whining note and keeping well within reaching distance of the pouch. When the critical moment arrives the pelican throws the bill up and attempts to swallow the fish, but, with cat-like quickness, one or both gulls make a similar effort, and should the fish in its struggles have thrust its tail or head past the edges of the mandibles, as very often happens, it is an even chance that the gull gets the prize; in fact, I have often seen a Heermann gull reach well into the pouch and get away with a fish in the very act of slipping down the throat of the pelican.
>
> I remember a very amusing incident of this nature I once witnessed on the coast of Lower California. The pelican, after securing a herring, "backed

> water" until it was supposed to be far enough from its parasite to venture swallowing it, but as the huge bill was tipped up and opened the gull plunged forward and thrust its entire head and neck into the pouch; the pelican, somewhat quicker than most of its kind, closed down with a snap and caught the intruder, which in turn had caught the fish; neither would yield any advantages gained, and for perhaps half a minute the pelican towed the gull about by the head, amid most violent protest from a hundred or more gulls assembled, while other pelicans sat like solemn judges, perhaps offering to arbitrate the question. At last a more violent twist than usual on the part of the gull freed him from limbo, minus a few feathers, but in no manner daunted, for a moment later it was following closely in the wake of the same pelican, waiting for it to plunge for another fish, and I never did learn which really swallowed the one in controversy.

Dr. E. W. Nelson (1899) observed that "these gulls are bold and noisy aggressors when they wish to take advantage of the gannets, and about the breeding places of the latter they feed largely at the public expense." One that he shot on Isabel Island, off the west coast of Mexico, had in company with its mate "harried a blue-footed gannet into disgorging a number of small fish upon a rock at the edge of the water, and was picking up the spoils by a series of little downward swoops and hoverings." Mr. Harold H. Bailey (1906) in the same region, noted similar behavior toward the boobies. He also mentions the following incident:

> One day while sitting on a rock in front of camp at White Rock waiting for lunch, I saw one of a pair of great rufous-bellied kingfishers fishing from a rock about 20 feet farther on. As it returned to its perch from one of its little plunges a Heermann's gull swooped down and tried to get its food before it could be swallowed. The kingfisher dove to the water and at each descent of the gull, dove below, these tactics being kept up until the gull got disgusted and left.

Winter.—At the close of the breeding season the Heermann's gulls migrate northward along the coast of California and as far north as British Columbia. They have been seen flying north along the coast of Washington as early as July. Adults become abundant on the California coast in July and young birds in August. They are common all winter on the coast of southern California, both adults and young, until the adults migrate south again in the spring to breed.

DISTRIBUTION.

Breeding range.—Pacific coast of Mexico. Known to breed in the Gulf of California (Isla Raza and Ildefonso Island), Lower California (Magdalena Bay), on the Tres Marias Islands, and at Mazatlan.

Winter range.—Northward in summer along the Pacific coast to northern Washington (Puget Sound), and occasionally to northern Vancouver Island. Southward along the Central American coast to Guatemala (Chiapam and San José).

Spring migration.—Adults return to their breeding grounds from both northern and southern winter ranges in March.

Fall migration.—Northward movement begins in May, reaching southern California about June 1; Monterey, June and July; Farallones, May 20 to June 3; British Columbia, Vancouver Island, June 28. Southward retirement again begins in August, or even July, but last birds do not leave Puget Sound until October, and few remain in Washington until November. Bulk of the flight passes Monterey in November, but a few birds winter there.

Egg dates.—Mexico, west coast: Fifteen records, April 8 to June 17; fourteen records, April 8 to 11.

LARUS ATRICILLA Linnaeus.

LAUGHING GULL.

HABITS.

High above the gleaming sands of Muskeget Island, amid the whirling maze of hovering terns that swarm up into the blue ether until the uppermost are nearly lost to vision, may be seen some larger birds, conspicuous by their size, by their black heads and black-tipped wings, soaring at ease among their lesser companions. In the ceaseless din of strident cries may be heard occasionally the hoarse notes of this larger bird—notes which, from their peculiar character, give the bird the fitting name of laughing gull. Although larger and stronger than the terns the laughing gulls are much shyer and less aggressive on their breeding grounds; the observer must remain concealed for some time under a well-made blind before they will return to their nests in his vicinity.

The Muskeget Island colony is certainly the largest breeding colony of laughing gulls north of Virginia; it is therefore worthy of description, as typical of the numerous colonies which formerly existed all along the coast from Maine southward. Much has been written about this interesting island, and I have given a brief description of it under the head of the common tern. These gulls formerly bred here abundantly, but constant persecution reduced their numbers until they became very scarce about 1880, and would have been extirpated except for the protection afforded them by the passage of suitable laws and by the personal efforts of Mr. George H. Mackay in seeing that the laws were enforced. They increased slowly during the next 10 years, but after 1890 their increase was more encouraging. In 1894 the colony nearly doubled in numbers and it continued to flourish, increasing a little each year, until, at the time of my last visit (in 1919) it consisted of several thousand pairs.

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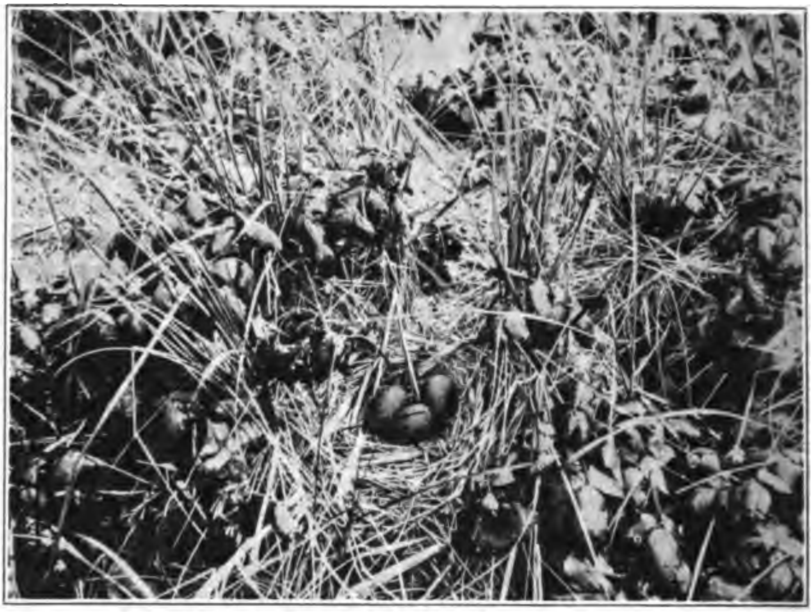


Muskeget Island, Massachusetts. A. C. Bent.

Muskeget Island, Massachusetts. A. C. Bent.

LAUGHING GULL.

FOR DESCRIPTION SEE PAGE 332.

Nesting.—The laughing gulls usually arrive at Muskeget during the second week in May, the date of arrival varying from May 7 to 17, according to the weather conditions. A period of warm weather with strong southerly winds in the first part of May is likely to bring them early, flying high in the air with the terns. Mating and nest building soon begin and the first eggs are laid during the first or second week in June. They build their nests in a compact colony, among the sand dunes, near the center of the island, where the beach grass grows long and thick on the sandy slopes and in the hollows between the dunes. Usually the nests are, at least partially, concealed in the beach grass, which grows 2 feet high or more, but often they are in plain sight. When the nest is placed in the thick grass, a well-trodden path over-arched with grass leads up to it on one side and away from it on the other, so that the bird may enter and leave the nest without turning around at the risk of ruffling its immaculate plumage. The nests are frequently placed among the beach peas, which grow in great profusion in the hollows among the sand dunes, or, again, they are found under bayberry bushes that are scattered all over the island—sometimes in the center of a clump. The nest is sometimes merely a hollow in the sand among the beach grass, lined with dry grasses, bits of sticks and rubbish; but usually it is a well-made structure of various coarse, dry grasses, firmly interwoven and built up a few inches above the sand among clumps of beach grass, beach peas, or poison-ivy vines. The interior of the nest is carefully rounded and neatly lined with fine dry beach grass. By the middle of June most of the nests contain full sets of eggs, though egg laying is continued more or less all through the month. Very few chicks are hatched before July, but during the first week in that month the majority of the young birds appear and may be found hiding in the beach grass or running about so nimbly that it is difficult to catch them.

Similar colonies formerly existed along the Long Island coast, where in Giraud's day the laughing gull was a common summer resident. It occurs there now chiefly as a migrant, and I doubt if there are any breeding colonies left. According to Mr. William Dutcher's notes it bred at South Oyster Bay up to 1884, at Amityville until 1887, and at Cedar Island as late as 1888.

Dr. Witmer Stone (1908) says of its status in 1908 in New Jersey:

> Formerly an abundant summer resident on the salt meadows along the coast, it is now restricted to two colonies—one at Brigantine and the other on Gull Island, Hereford Inlet—both under the protection of the National Association of Audubon Societies. The birds arrive April 4 to 20, and have mostly departed by October 1. The first sets of eggs are laid in May.

On Cobb's Island, Virginia, and on the surrounding islands we found the laughing gulls still abundant in 1907, though considerably reduced in numbers by many years of persecution. Their eggs were persistently collected daily by the oystermen all through the breeding season up to July 4, after which date they were protected by law and the birds were allowed to raise their broods. Such treatment must prove discouraging to the less vigorous birds and probably will eventually drive many of them away, but the oystermen claim the right to collect the eggs as a legitimate food supply, and it would be difficult to enforce any more stringent laws for their protection. The establishment of reservations under the constant guardianship of resident wardens is the only practical solution of the difficulty. Their favorite breeding grounds in this region are on the salt meadows, which are partially covered with shallow water at the highest tides. There are numerous small islands in this vicinity known as "marshes," which form their principal breeding grounds. These are flat and muddy, only a foot or two above the ordinary high tides and covered with short salt meadow grass. The nests are well made, bulky structures of dead grasses and sedges, firmly interwoven and neatly lined with finer grasses. They are built up high enough to be above the reach of the spring tides.

The largest and most prosperous colonies of laughing gulls that I have ever seen were in the reservations off the coast of Louisiana, where, under rigid protection, the seabird colonies are still flourishing. Between June 16 and 24, 1910, I made the circuit of the islands with Warden W. M. Sprinkle, on his weekly patrol, visiting all of the more important colonies. The largest colony was on Battledore Island, where a resident warden was protecting the birds most successfully. I spent the whole of a long day on this little island and estimated that there were fully 5,000 pairs of laughing gulls breeding here, as well as 1,000 pair of black skimmers, 50 pairs of Lousiana herons, 30 pairs of Forster's terns, 25 pairs of common terns, one pair each of Caspian and royal terns, and a few pairs of Florida redwings, all of which seemed to be living together in perfect harmony. The island was formerly much larger, but had been reduced in size by the washing away of its shelly and sandy beaches, leaving broad stretches of sand and mud flats around it, bare at low tide. We had to walk at least half a mile over these flats to reach the dry portion of the island, which was not over 4 acres in extent. In the center was a flat and almost dry marsh, largely overgrown with small black mangrove bushes, in which the Louisiana herons were nesting. Surrounding this, and partly inclosing a shallow muddy bay, were high ridges of finely broken oyster shells sloping down to the sandy beaches. The laughing gulls' nests were thickly scattered over nearly all of the island, principally among the clumps of grass and coarse weeds or under small bushes, on and behind the shell ridges, but also on the marsh and on the muddy flats and sandy beaches, which were partially covered with grass and weeds. The nests on the dry ground or among thick vegetation were not so elaborately built as those on the open marsh. At this date (June 21) most of the eggs were heavily incubated, pipped, or hatched. According to Captain Sprinkle's records the majority of the eggs are laid during the last week in May and hatched about three weeks later. The gulls on this island were particularly tame, being accustomed to the daily visits of the warden. They alighted on their nests readily within 10 feet of my blind, and even in the open, if I sat down quietly, they would soon settle on the ground within easy reach of my camera.

On the outermost island in this reservation, Grand Cochere, a low flat sand bar, we found a few pairs of laughing gulls with nests scattered over the island somewhat apart from the large breeding colonies of royal and Cabot's terns, with which the island was chiefly populated. The nests were poorly made of the scant supply of grasses, seaweed, and rubbish available. As there was absolutely no vegetation on this bare sand bar, the nesting material must have been brought from a distance. In marked contrast to our experience elsewhere we found many broken eggs of the terns which had apparently been eaten by the gulls; we therefore thought it wise to discourage their nesting here and broke up all the nests we could find, about 10, and shot several of the birds.

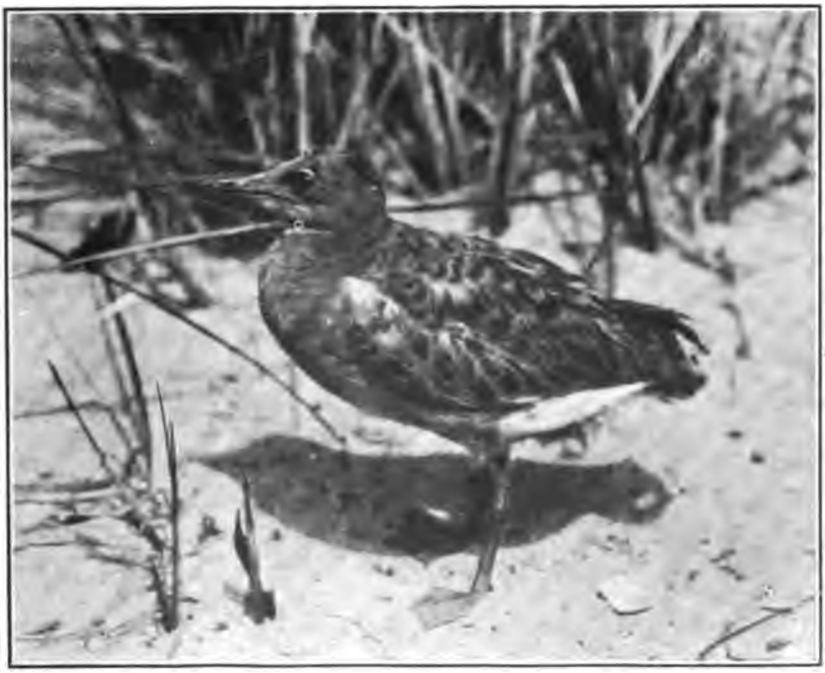
Among the numerous small islands in the western part of the reservation, near the delta of the Mississippi River, we found a large number of breeding colonies of laughing gulls varying in size from 50 or 100 pairs up to 1,000 or 2,000 pairs. Some of the larger islands were of the same type as Battledore Island, but more of them were of the marshy type, locally known as "mud lumps," overgrown with rank grasses, low mangrove bushes, and other vegetation. Wherever there were shell or sand beaches black skimmers were nesting. There were numerous breeding colonies of Louisiana and black-crowned night herons in the red mangrove thickets; a few colonies of Forster's terns were breeding on the marshes; and there were a few scattering pairs of Caspian terns; but everywhere the laughing gulls predominated and apparently lived peacefully with their neighbors.

Eggs.—Three eggs usually constitute the full set, though four eggs are frequently laid, and sometimes only two. Mr. George H. Mackay (1893) speaks of finding a number of nests with five eggs each, and suggests the possibility that these may have been laid by more than one bird. The eggs vary in shape from ovate, or slightly elongated ovate, to short ovate, the prevailing shape being typical ovate. The ground color varies from "Isabella color" or "wood brown" in the darkest specimens to "olive buff" or "cream buff" in the lightest specimens, both of which extremes are unusual. The prevailing types show various intermediate shades of "olive buff" or "olive brown," or, more rarely, a pale olive greenish tinge. I have one set in which the ground color is very pale "pea green" and is almost immaculate. The markings consist of spots and blotches, or more rarely irregular scrawls, scattered more or less evenly over the egg, but often more thickly about the large end. These vary in color from "seal brown" or "clove brown" to "Mars brown" or "raw umber." In many specimens there are underlying spots or blotches of "drab gray" or "olive gray." The measurements of 69 eggs in the United States National Museum collection average 53.5 by 38.5 millimeters; the eggs showing the four extremes measure 62 by 37, 52 by 42, 48.5 by 37, and 52.5 by 30.5 millimeters.

Young.—The period of incubation is about 20 days. The young when first hatched are carefully brooded by their parents, who stand over them to protect them in wet weather or to shield them from the rays of the hot sun. They are fed at first on half-digested soft food, which they take from the open bill of the old bird, but later on are weaned and taught to feed on solid food. They remain in the nest for a few days, but soon learn to run about and hide in the grass or under herbage. For the next month or six weeks they lead an inactive life during the period of growth-feeding, resting and sleeping most of the time. They are fed by their parents until they are able to fly and for some little time thereafter. The flight stage is reached, on Muskeget, during the last week of July or the first week of August, at which time the adults, still in full nuptial plumage, may be seen hovering over the little grassy meadows, where young birds of various sizes may be found hidden in the long thick grass, so well concealed that one must be careful not to walk on them. Here they remain motionless until disturbed, often until touched, when they run nimbly or fly away. Comparatively few young birds may be seen exercising in the open sandy spaces or on the beaches, running about on their long legs almost as fast as a man can run, or learning to make short flights from the high spots.

Plumages.—The young are thickly covered with long, soft down. The prevailing color above is "wood brown" or "drab," which is often more or less extensively tinged with "tawny olive" or "cinnamon,' and the under parts show paler shades of the same colors tinged with "tawny ochraceous" on the breast or throat. There is no white below. The head, neck, and throat are clearly spotted or striped with dull black, dusky, or very dark brown; and the back is more or less heavily mottled or clouded with the same dark colors.

Muskeget Island, Massachusetts. A. C. Bent.



Muskeget Island, Massachusetts. A. O. Gross.

LAUGHING GULL.

FOR DESCRIPTION SEE PAGE 332.

The juvenal plumage is complete before the young bird is fully grown. In the fresh juvenal plumage the upper parts are largely dusky drab, but the feathers of the back, scapulars, and lesser wing-coverts are broadly tipped and margined with "cinnamon buff" or "pinkish buff." The head, neck, and chest are heavily clouded with dusky, the sides of the head being nearly clear dusky, darkest on the lores, and the feathers of the neck and chest are narrowly tipped with pale buff. The throat is partially white, and the under parts are whitish, clouded with drab on the sides. The greater wing-coverts are dusky, broadly edged with gray, and white tipped. The remiges are black; the tertials and secondaries broadly and the inner primaries narrowly tipped with white. The tail is basally pearl gray, the outer third or more black, and is tipped with white. As the season advances buffy edgings on the upper parts wear away and fade out to whitish. A gradual postjuvenal molt also takes place during the fall and winter with the growth of new "gull gray" feathers in the back and new white feathers in the head, neck, and breast. This molt is practically continuous with the first prenuptial molt, which produces further advance toward maturity; the head becomes largely white, the under parts wholly so, the scapulars and lesser wing-coverts become "gull gray," and sometimes some, or even all, of the tail feathers are replaced by new pure white feathers; but usually the rectrices, the remiges, and the greater wing-coverts remain as in the juvenal plumage.

I can not find any evidence that the slate-colored head of the adult nuptial plumage is even partially assumed at this age.

At the first postnuptial molt, when the bird is a little over a year old, the adult winter plumage is assumed by a complete molt, but a few individuals may still retain traces of the black subterminal bar in the tail, or other signs of immaturity. In the adult winter plumage the dark hood of the adult nuptial plumage is replaced by a white head, mottled with dusky on the occiput, cervix, and auriculars; the inner primaries are conspicuously white tipped, decreasingly so outwards until the outer is entirely black; these white tips wear away during the winter. The complete postnuptial molt begins in July and is usually completed in September, but sometimes not until October; the outer primaries are the last feathers to be renewed. Apparently young birds molt earlier in the summer than adults, beginning sometimes as early as May. The partial prenuptial molt occurs mainly in March, and involves the contour feathers and the lesser wing-coverts. Dr. Elliot Coues (1877) gives a striking account of the changes which take place at this season:

> Another change heightens the beauty of the birds when they are to be decked for their nuptials in full attire. They gain a rich rosy tint over all the white plumage of the under part; then few birds are of more delicate hues than these.

> Nature blushes, filling the bird's breast with amorous imagery, till the feathers catch a glow and reflect the blush. Burning with inward fire, the whole frame thrills with the enthusiasm of sexual vigor. The dark glittering eye is encircled with a fiery ring; now it flashes defiance at a rival, now tenderly melts at sight of his mate, soon to be sacrificed to masculine zeal. The breath of desire seems to influence the mouth till it shares the carmine hue that tinges other parts. The birds speed on high with vigorous pinion, making haste to the wedding with joyful cries till the shores resound. But such ardor is too consuming to last; with the touch of a moment the life current flies like an electric shock, lighting a fire in another organism, only to be subdued in the travail of maternity; not only once, but often, till the tide ebbs that at its flood transfigured the bird. Its force all spent the change comes; the red mouth pales again; the glowing plumage fades to white; the bird is but the shadow of his former self, dull-colored, ragged, without ambition beyond the satisfaction of a gluttonous appetite. He loiters southward, recruiting an enervated frame with plenteous fare in this season of idleness, till the warm rays of another spring restore him.

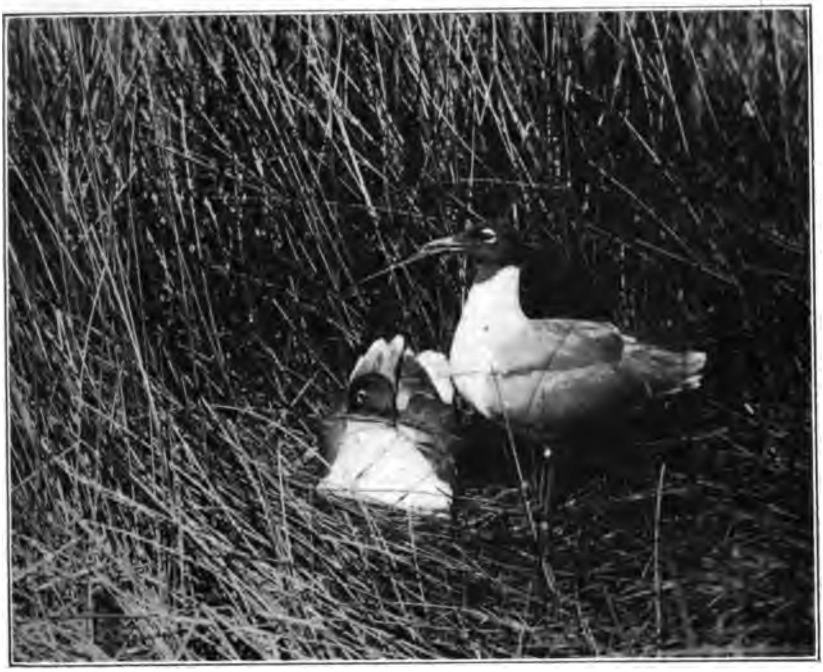
Food.—The food of the laughing gull is quite varied. It consists largely of small fish or fry which it catches for itself on the surface or steals from the brown pelican. This latter performance is quite interesting. Wherever a number of pelicans are diving and feeding these gulls are apt to gather in large numbers, and with their warning cries of "*half*, *half*, *half*," to share in the feast. As soon as a pelican appears above the surface with a pouch full of small fry one or another of the gulls attempts and often succeeds in alighting on the pelican's head and helping itself to the bountiful supply in the capacious pouch. Other gulls hover about and pick up the pieces that fall to the water. Audubon (1840) states that they eat the eggs and sometimes the small young of the noddies and sooty terns on the Dry Tortugas. I have seen some evidence of their egg-eating habits, but I think they are not nearly as bad in this respect as the larger gulls. Mr. Stanley C. Arthur writes me:

> The laughing gull takes a heavy toll of the eggs of the Cabot and royal terns every year; of this there is no doubt; and it seems to favor the royal tern in this matter of egg breaking. While I have seen a number of Cabot tern eggs broken open by laughing gulls, there is no doubt that the royal tern suffers the most.

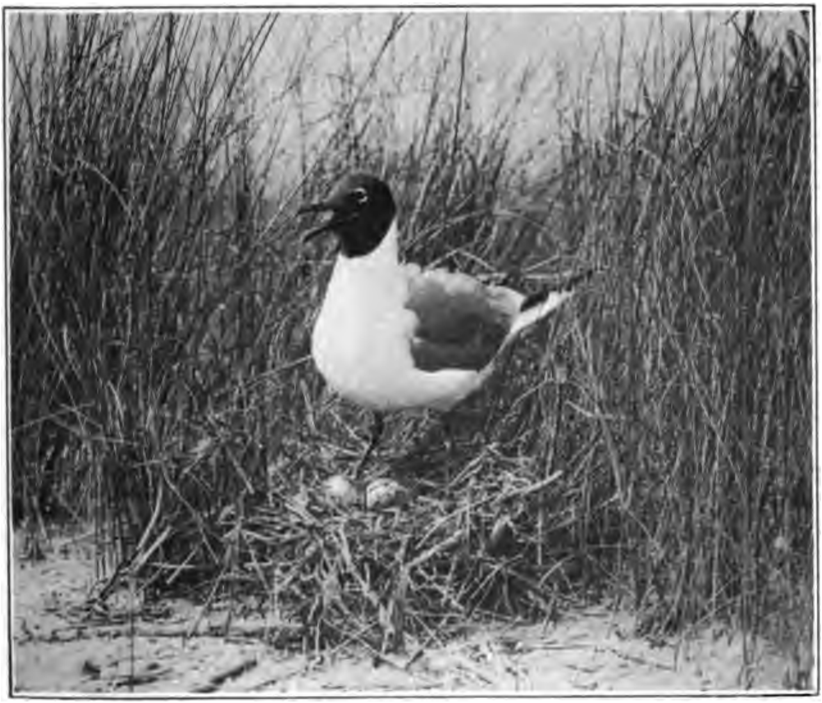
Mr. John G. Wells (1902) says:

> As these gulls can not dive they have to depend for their food on the shoals of sprats and fry that come up to the surface; and they have been known to take large bites from the backs of a fish called corvally which swims near the surface in large numbers. After heavy falls of rain, when the pastures are covered with numerous rain pools, these gulls resort to them in numbers and feed on the earthworms which swarm in the pools. This may often be seen, especially in the Beausejour pasture.

Although not such scavengers as the larger gulls, the laughing gulls are not above eating quite a variety of garbage, and I have known them to follow our boat for long distances, while we were



Louisiana. H. K. Job.



Louisiana. A. M. Bailey.

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cruising in the Gulf of Mexico, to pick up the few scraps that were thrown overboard. Laughing gulls are frequently pursued by jaegers, and in tropical waters by man-o'-war birds, and after much darting, twisting, and turning they are finally forced to disgorge their food.

Behavior.—The characteristic notes of the laughing gull have been well described by Mr. J. H. Langille (1884), from which I quote as follows:

> From the hoarse clatter of the terns one could distinguish its long-drawn, clear note, on a high key, sounding not unlike the more excited call note of the domestic goose; and every now and then it would give its prolonged, weird laughter, which has given rise to its common name. To one who has heard it it might be imitated by the syllables, *hah-ha-ha-ha-ha-hah-hah-hah*, all of which are uttered on a high, clear tone, the last three or four syllables, and especially the last one, being drawn out with peculiar and prolonged effect; the whole sounding like the odd and excited laughter of an Indian squaw, and giving marked propriety to the name of the bird.

The flight of the laughing gull is light and graceful, yet strong and well-sustained. When migrating or flying long distances in pleasant weather, they usually fly high in the air, but in stormy weather or when flying against a strong wind they fly close to the water or low over the land. In pleasant weather large numbers of them leave their breeding places soon after sunrise, flying in flocks or long lines to their feeding grounds, and return before sunset, flying low in broadly extended formations.

The laughing gulls on Muskeget Island seem to live in perfect harmony with their neighbors, the common and roseate terns. I have never found any positive evidence of their eating the eggs of these terns, although they eat the eggs of other species elsewhere. They seem to be shyer or more timid here than at other places, and perhaps they have learned that it is not safe to molest the more aggressive terns. Mr. Mackay (1893) says:

> I shall not call them courageous birds, as far as I have observed them, for I have frequently seen a single *Sterna hirundo* chase or put one to flight, which would endeavor to escape without offering any resistance. I have also seen four or five laughing gulls concertedly chase and put to flight a single *Sterna hirundo*, which offered no resistance to such odds.

These observations tend to show that the terns are the masters of the situation and that the gulls simply have to respect their rights. After the breeding season is over the old and young birds wander about our coasts until they finally disappear on their southward migration about October 1.

Winter.—The fall migration begins in August, and by the end of September most of the laughing gulls have disappeared from the New England coast. Many linger on the North Carolina coast through November, and from South Carolina southward they are abundant all winter, frequenting the bays and tidal estuaries in large flocks. They are strictly maritime at all seasons and seldom wander inland or up the rivers beyond tidewater. Their winter range extends to the west coast of Mexico, Peru, and Brazil, where they associate with royal terns, brown pelicans, and man-o'-war birds on relations which are often more intimate than friendly.

Mr. G. K. Noble (1916) has recently called attention to the fact that the laughing gulls of the North American coasts are larger than those of the West Indies and has given the former a new name, *Larus atricilla megalopterus* (Bruch).

DISTRIBUTION.

Breeding range.—Along the Atlantic and Gulf coasts (formerly at many localities now deserted) from central Maine (Lincoln County) to southern Texas (Cameron County). Principal colonies are in Massachusetts (Muskeget Island), Virginia (Northampton County), Louisiana (various islands), and Texas (Padre and Bird Islands). Birds breeding in the Bahamas and West Indies have been separated as a smaller subspecies, to which probably belong the birds breeding on the coastal islands of Venezuela and Honduras.

Breeding grounds protected in the following national reservations: In Florida, Passage Key; in Louisiana, Breton Island, and Shell Keys.

Winter range.—From the Bahamas, coasts of South Carolina, Mississippi, and Louisiana southward, mainly in the Gulf of Mexico and the Caribbean Sea. It is impossible to separate the winter ranges of the two subspecies, but the species has been taken in winter as far south as Brazil (Cajutuba), and on the Pacific coast from central Mexico (Mazatlan) to Peru (Santa Lucia) and coast of Chile.

Spring migration.—Migrants arrive in North Carolina in April and May; Virginia, about April 1; New Jersey, April 6 to May 1; Massachusetts, Muskeget Island, April 12.

Fall migration.—Late dates of departure: Massachusetts, Nantucket, October 8; New York, Long Island, October 28; New Jersey, September 20 to October 1; South Carolina, Weston, October 20.

Casual records.—There are numerous inland records of stragglers, as far north as Quebec (Montreal, October 24, 1888), and Ontario (Toronto, May 23, 1890), and as far west as Iowa (Blencoe, October 10, 1894), Colorado (near Denver, December, 1889), and New Mexico (Fort Wingate). Accidental in Bermuda (winter of 1881–82), Lower California (San José del Cabo, September 6 and November 9, 1887), Great Britain (several old records), France (Le Crotay, June 29, 1877), and Austria (near Trieste, winter).

Egg dates.—Virginia: Forty-eight records, May 25 to July 19; twenty-four records, June 9 to 26. Louisiana and Texas: Thirty-three records, April 8 to June 21; seventeen records, May 21 to June 4.

LARUS FRANKLINI Richardson.

FRANKLIN'S GULL.

HABITS.

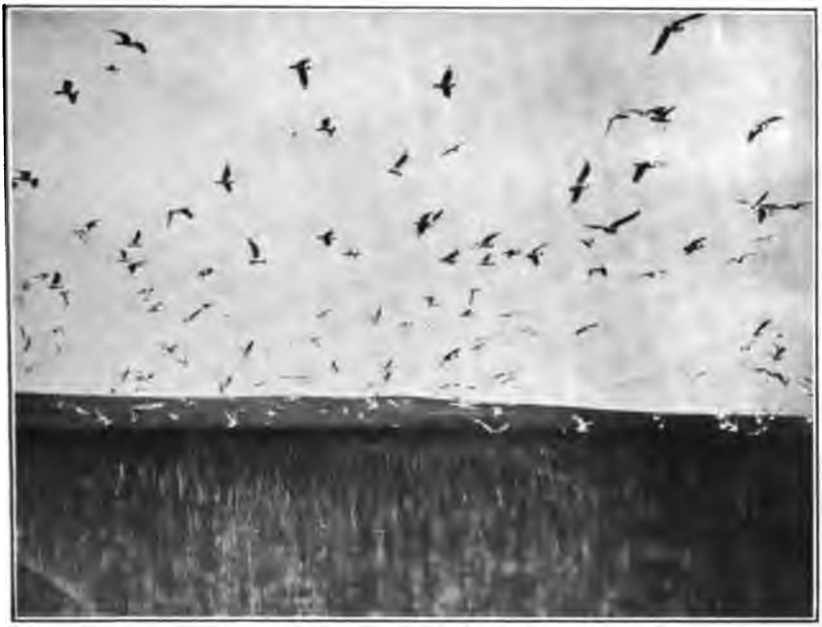
> *Spring.*—In late April or early May, when the rich black soil has thawed to the surface, the settler of the northwest prairies goes forth to plow. The warm season is short and his tillage vast, so he delays not for wind or storm. One day he is dark as a coal heaver, when the strong winds which sweep almost ceaselessly over the prairie hurl upon him avalanches of black dust. Next day, perchance, in a driving storm of wet snow, he turns black furrows in the interminable white expanse, his shaggy fur coat buttoned close around him. Then comes a day of warm sunshine, when, as he plows, he is followed by a troop of handsome birds which some might mistake for white doves. Without sign of fear they alight in the furrow close behind him, and, with graceful carriage, hurry about to pick up the worms and grubs which the plow has just unearthed. Often have I watched the plowman and his snowy retinue, and it appeals to me as one of the prettiest sights which the wide prairies can afford. No wonder that the lonely settler likes the dainty, familiar bird, and in friendly spirit calls it his "prairie pigeon" or "prairie dove."

The above quotation, from Mr. H. K. Job (1910), furnishes a vivid picture of this useful prairie bird and its arrival in the spring, which occurs at about the time that the last of the ice goes out of the lakes. The beautiful Franklin's gull, or Franklin's rosy gull, as it was first called, is both useful and ornamental throughout the whole summer, and is justly popular in consequence. Although it was described by Swainson and Richardson in Fauna Boreali-Americana, it seems to have been almost wholly unknown by the earlier writers on American birds, and was for many years considered a rare bird. It was not until the great western plains began to be settled and cultivated that we began to realize the astonishing abundance of this species and its importance to the agriculturist.

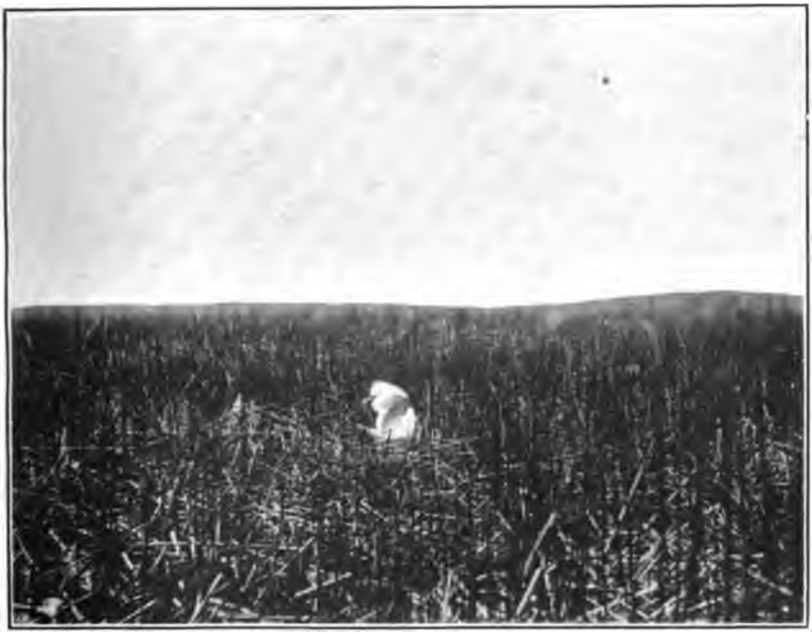
Nesting.—A breeding colony of Franklin's gulls is one of the most spectacular, most interesting, and most beautiful sights in the realm of North American ornithology. The man who has never seen one has something yet to live for—a sight which once seen is never to be forgotten. No written words can convey any adequate idea of the beautiful picture presented by countless thousands of exquisite birds, of such delicate hues and gentle habits, in all the activities of their closely populated communities. For parts of two seasons we had followed their elusive lines of flight over many miles of prairie and plain. We had seen them flying out in loose straggling flocks in the morning as they scattered over the prairies to feed and seen them flying back again at night to some mysterious point which we could never find; whence they came and whither they went we never knew, but somewhere in the great beyond we knew that they had established a populous city. Like the Indians of the plains, they are a wandering, nomadic race, and for some mysterious reason, unknown to any but themselves, they move about from place to place, choosing each season the locality which suits their fancy.

At last our efforts were rewarded on June 9, 1905, for after driving for miles over the rolling plains of southwestern Saskatchewan and exploring many lakes and sloughs in vain we discovered a splendid colony of these elusive birds. As we drove over the crest of a billowy ridge among roving bands of grazing cattle we saw a broad level grassy plain spread out before us, and beyond it in the distance a lake fringed with marshes. With the aid of our glasses we could barely make out a cloud of white specks hovering over the marsh, and we knew at once that we had won the long-sought prize. Another mile of rapid driving brought us to the marshy shore, where scores, yes hundreds, of the dainty birds began flying out to meet us with a chorus of shrill screams and harsh cries of protest. We tethered our horse and waded out into the marsh, where the reeds or bullrushes (*Scirpus lacustris*) grew for a distance of 200 or 300 yards out from the shore and for half or three-quarters of a mile along that side of the lake. The water was not over knee-deep anywhere, except on the outer edge, and usually much less than that; perhaps a foot deep on the average. The reeds were 3 or 4 feet high and were not very thick except on the outer edge, where they grew in thick clusters, dense and tall. Most of the reeds were of last year's growth, dead and more or less flattened down, with scattering tall, straight, green reeds growing up through them.

As we waded out toward the colony, clouds of gulls began to rise and circle over us, cackling and screaming, but it was not until we were 100 yards from the shore that we began to find nests. When we were fairly in the midst of the colony the excitement grew intense; clouds and clouds of the beautiful birds were rising all around us, and the din of their voices was terrific, as they hovered over, circled around, and darted down at us in bewildering multitudes. If we kept still they would gradually settle down all around us, but if we gave a shout the result would be startling as the whole surrounding marsh would seem to rise in a dense white cloud, and the roar of their wings mingled with the grand chorus of cries would be almost deafening. But they were very tame and we had plenty of opportunities to admire the exquisite beauty of their plumage, seldom surpassed in any bird; pearl gray mantles, delicate rosy breasts, black heads, and claret-colored bills and feet. We could form



Lake of the Narrows, Saskatchewan. H. K. Job.



Lake of the Narrows, Saskatchewan. A. C. Bent.

FRANKLIN'S GULL.

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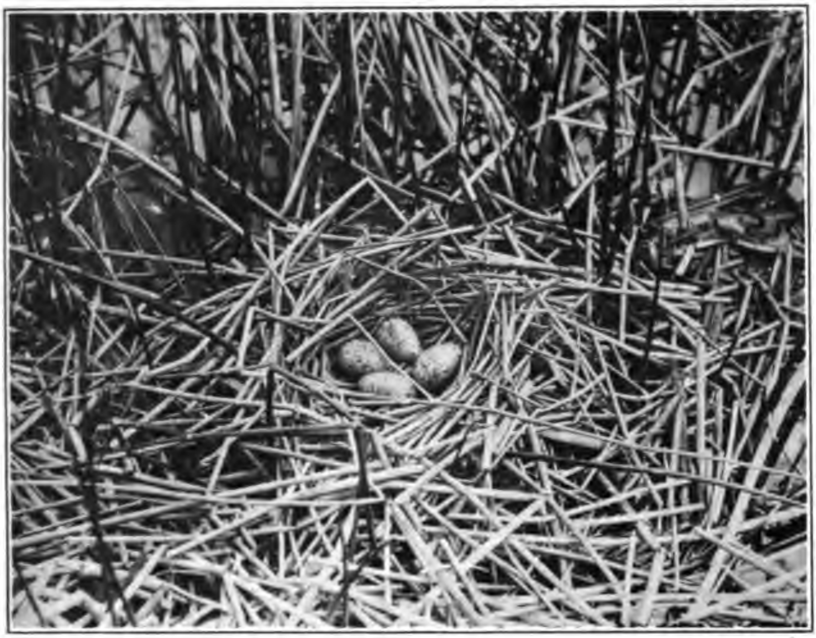
no very definite idea of their numbers, but there were certainly a mighty host of them; to say that there were thousands would be putting it mildly, for their nests were as thick as they could be over a large area. Assuming that there were from 15 to 20 nests in an area 10 yards square, or in 100 square yards, which is certainly a conservative estimate, I figured that there were at least from 15,000 to 20,000 nests in the colony, meaning a population of from 30,000 to 40,000 birds.

As we stood wondering and admiring them, they grew more confident and gradually settled down on their nests all around us, and sometimes within 10 yards of us. They seemed less afraid of us than of the cameras, for they would not alight on their nests very near the latter. We got the best results with the Reflex cameras. They had many a little squabble among themselves; they seemed to be disputing the ownership of the nests, fighting over it in the air, or if one alighted on the wrong nest a quarrel would arise with the rightful owner; but as a rule each bird returned to its own nest with remarkable accuracy, and it is a wonder that mistakes were not more often made amid such a vast confusion of nests and birds. They frequently alighted in the little open pond holes among the reeds, where they floated lightly on the surface, swimming about in graceful elegance. Many of them alighted on the lake out beyond the reeds, where they swam about with the eared grebes, scaups, and canvasbacks. There was quite a large colony of the grebes nesting among the reeds with the gulls.

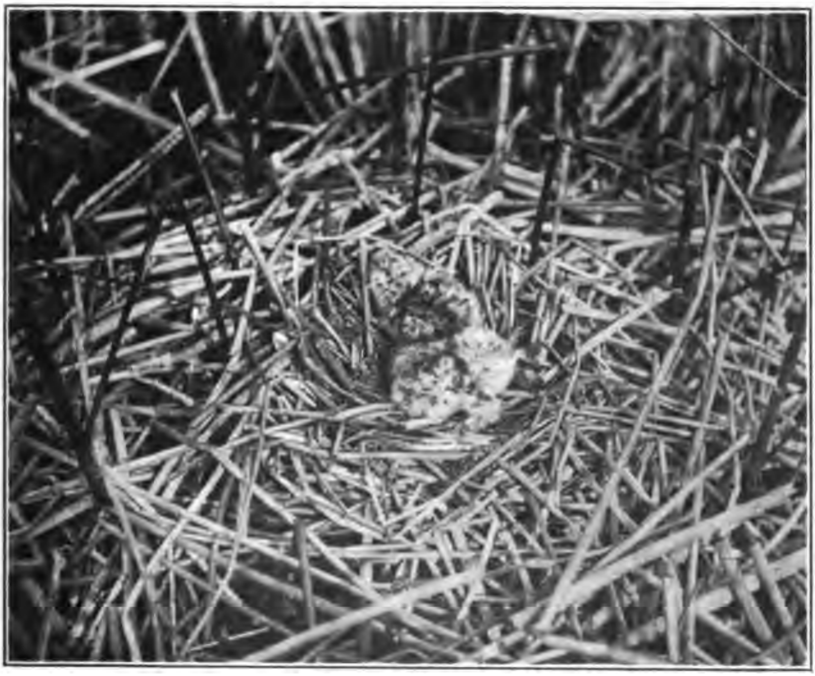
The gulls' nests began about 100 yards from shore and extended uniformly over all the reedy area to the outer edge, where they were, if anything, more abundant than elsewhere. It seems as if a nest had been placed in every available spot, and it was difficult to walk without stepping on or overturning them. They were in the open places and in the thick places as well. The nests were generally large floating masses of dead reeds, but sometimes they were well built up among the green standing reeds and well secured. In the latter case the nests were smaller. They varied greatly in size and manner of construction. A few that I measured, representing a fair average, were from 12 to 30 inches in diameter, and were built up from 4 to 8 inches above the water; the inner cavity, which was but slightly hollowed, was usually about 5 inches across. The nests on the outer edge of the reeds seemed to have been occupied first, as it was here that we found most of the young. Practically all of the eggs collected here were heavly incubated, whereas in the nests farther inland we found many fresh eggs and incomplete sets, but no young. Three eggs were the usual number, though complete sets of two were very common. We found in all four sets of four, but in these some of the eggs were fresh and some heavily incubated, showing that they were probably laid by two birds. After collecting a few sets of eggs and exposing a lot of plates we reluctantly came away, not having fired a gun among the beautiful and confiding birds. We even refrained from killing one which had become tangled in the reeds and was easily caught. We visited this locality again the following year, but were disappointed to find it entirely abandoned by the gulls, which was probably due to the fact that the lake had been very dry earlier in the season when they were beginning to nest.

The colony described above was undoubtedly unusual, as this species generally nests in a more open marsh in deeper water and often in quite exposed situations in marshy lakes. In the three other colonies that I have seen the nests have been floating in water which was waist deep, or deeper, and many of the nests could not be reached without a boat. Dr. Thomas S. Roberts (1900) describes a typical deep-water colony in his account of the nesting habits of this species at Heron Lake, Minnesota, in 1899. He says:

> At a distance of about an eighth of a mile from the marshy, reed-grown shore, the little floating mounds dotted thickly a great crescent-shaped area some three-fourths of a mile in length by 300 or 400 yards in the widest part. The nests were irregularly distributed. In some places there were many close together, and again they were scattered yards apart, while now and then there were large spaces where there were none at all.
>
> Under ordinary conditions the water over all this area would have been 2 or 3, nowhere over 4 feet deep, with a thick growth of bullrushes (*Scirpus*) standing well above the surface. But heavy rains had raised the lake until the water was in many places fully 6 feet deep and only the tops of the tallest rushes came into view; thus changing a large part of the nesting ground from a dense tangled bed of rushes into almost open water. Upon this condition of things the birds, of course, had not reckoned when they chose the site, and in consequence many of the nests were now torn from their moorings, having been lifted by the rising water, and were unprotected save by the weak tops of the submerged rushes. Thus free to drift, they were floating hither and thither at the mercy of the winds, but, strange to say, this state of things did not appear to greatly disconcert the owners. Here and there a number of nests had caught against some firm anchorage, and, receiving new additions with each favorable breeze, a windrow, or island, of these stray nests was soon formed. Nest touching nest in this manner resulted in a promiscuous crowding of families that must have tested the good nature and forbearance of the occupants not a little, and probably led to some vagaries in the care of the young described further on. A few nests had gone adrift entirely, and floating far out into the open water had been abandoned. But luckily a considerable part of the colony, wiser than their fellows, escaped this dire confusion of disaster as the result of having located their nests where shallower water and stronger growth of rushes provided protection and safe anchorage even when the flood was at its height. From nest-building operations still in progress at the late date of our visit (June 16) we inferred that a few at least of the gulls that had lost their homes were reestablishing themselves in safer retreats farther back, having perhaps learned a lesson against future similar mishaps.



Lake of the Narrows, Saskatchewan. A. C. Bent.



Lake of the Narrows, Saskatchewan. A. C. Bent.

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The nests were all built of the same material—old water-soaked bullrushes—with sometimes a few fresh stems worked into the upper part. A heavy foundation of the thickest and longest rushes is first laid, forming a partly submerged platform held in place by the standing rushes about it, the whole being 2 to 3 feet across at the water line. Upon this the rather well-made superstructure of finer material is constructed, with a long slope from the water's edge up to the rim of the nest, which is raised 8 inches to a foot above the water. The cavity is 8 to 10 inches in diameter and 3 to 4 in depth, and is rudely lined with bits of fine rush tops and coarse grass. The inside is always perfectly dry, being several inches above the water. The variation in the nests was not very great, being merely as to general bulk and height. Much of the material of which the nests were constructed had been carried from a distance, probably from the neighboring shore, where the rushes, loosened by the ice, had been cast up in heaps. The gulls carry with apparent ease these great heavy rushes, and were often to be seen flying about for a considerable time with the long stems dangling from their bills. The nests were kept in good repair, and as they became trampled down or the rim disarranged the owners were to be seen putting things to rights or adding a new rush here and there as it was needed. At the time of our visit many young were already out of the shell, but there were also many sets of eggs in all stages of incubation, the result probably of second nest building.

Eggs.—As with most gulls the normal set of eggs is three; sets of four are rare, and often such sets are apparently the product of two birds; two eggs sometimes constitute a full set. The eggs show an interesting series of variations. In shape they are usually ovate, with some variation toward elliptical ovate. The shell is thin and almost lusterless. The ground color shows a great variety of buffy and greenish buffy shades, from "buffy brown" or "deep olive buff" to "cream buff," and from "ecru olive" or "water green" to "vetiver green" or "pale olive buff." Some eggs are sparingly spotted and others are quite heavily marked with large and small spots, blotches, or irregular scrawls, which sometimes are confluent into rings, of various shades of brown, such as "seal brown," "sepia," "bister," "Vandyke brown," and "burnt umber." Some eggs have a few spots of "lilac gray." The measurements of 48 eggs, in the United States National Museum collection, average 52 by 36 millimeters; the eggs showing the four extremes measure 56.5 by 37, 53.5 by 38.5, 47.5 by 35.5 and 49.5 by 34 millimeters.

Young.—I am inclined to think that both sexes incubate, for they are apparently affectionate and devoted to each other, both birds being often seen standing side by side on the nest. I believe that the male stands beside his sitting mate much of the time and relieves her by taking his turn on the nest. Dr. Roberts (1900) says that the period of incubation is "probably 18 or 20 days." He gives the following interesting account of the behavior of the young:

These pink-footed, pale-billed little balls of down now and then remain quietly in the home nest, basking in the warm sunshine, but more frequently they are no sooner dry from the egg than they start to wander. A few are content to go no farther than the broad sloping sides of the nest, and there they may be seen quietly dozing or tumbling about among the stems of the rushes as they explore the intricacies of their little island. The greater number, however, put boldly out to sea and drift away with the chance breeze, their tiny paddles of little avail as they pursue their now enforced journey. A gust of wind a trifle harder than usual, or a bump against a floating reed stem, and over they go bottomside up, only to come quickly right again, dry and fluffy as ever. Having, after many failures, crawled over the tiny obstruction, they sail contentedly on. Now and then they get out to sea in earnest and disappear, and are probably lost in the rough waters of the open lake. Their departure from the nests was apparently ever against the will of the old birds, and many were the scoldings and severe the punishments meted out to these venturesome offspring. A glance in the direction of some local outburst of furious cries would reveal a bevy of gulls crowded close together, beating the air and the water over a particular spot, where on closer inspection might be seen one or more of these hapless truants. The frenzy of the old birds as the chicks neared the open lake was pitiful to behold. With might and main they endeavored to turn them back, seeming not to realize their utter inability to stem the breeze even had they the inclination to make the attempt. At last, their protests of no avail, a resort is had to still more vigorous measures, and seizing the drifting chicks by the nape of the neck with the powerful beak they are jerked bodily and roughly out of the water, and from a height of 3 or 4 feet thrown as far as possible in the desired direction. This being repeated time and again—often several old birds taking part in the performance—until the youngsters are at last flung into some nest, exhausted and bleeding from the blows and pinches inflicted by the sharp bills of the parent birds.

This strange spectacle was of common occurrence, and these vigorous nursery duties seemed to occupy much of the attention of a goodly part of the members of this colony. Probably under ordinary conditions of water and protection such disturbances are less frequent. So far as the disciplining and care of the young went there existed a curious spirit of communisms among these gulls. An old gull cared for whatever young gulls fell in its way, and when the stray chicks chanced to clamber up into a strange nest, against which they happened to drift, they were, after a few admonishing squawks, welcomed as one of the household, and scolded, pecked, and fed just as though the foster parent had laid the eggs from which they were hatched. Now and then an entire brood would escape in a body, and crawling up beside some incubating bird on a neighboring windward nest would cuddle close about the old bird, who, to all appearances, was perfectly willing to adopt them in advance of the appearance of her own infants.

Occasionally we saw old gulls already in possession of a family twice the size to which they were entitled, rushing out and pouncing upon other fresh arrivals, who were quickly hustled and jerked up among the others until not infrequently 10 or a dozen of these tiny balls filled the nest to overflowing, and in the diversity of coloration presented plainly indicated their varied parentage.

Most jealously were these foundling asylums watched over and many were the fierce encounters in midair that resulted when some marauding band dared to interfere. A single gull, aided it might be by some accepted neighbor, fed apparently without distinction all these youngsters, and time and again we saw some little chap, just fished out of the water and still sore from the rough usage to which he had been subjected, fed to repletion by his captor, who disgorged into the tiny maw a juicy mass of dragon-fly nymphs brought from the meadows a mile away.

Plumages.—The downy young exhibit two color phases, with considerable variation in each. In the brown phase the upper parts are "wood brown" anteriorly, becoming "Isabella color" posteriorly; the throat and chest are "ochraceous buff," shading off to white on the belly. The back is heavily spotted or variegated with dusky, and the head is mottled with the same; there is a frontal black space at the base of the bill and usually a few dusky spots on the throat. In the gray phase the buff and brown tints are entirely replaced by light shades of "neutral gray" or "mouse gray," darker above and lighter below, the dusky markings on the upper parts being as described above.

The juvenal, or first plumage is acquired during July, previous to the flight stage. The back, scapulars, and lesser wing-coverts are "hair brown" and "drab"; the feathers edged with "wood brown;" the greater wing-coverts are gray; the primaries are dusky black tipped with white; the secondaries are centrally black, basally gray, broadly tipped, and edged with white; the tertials are dusky, broadly edged with white; the head is mottled with dusky and whitish above, white below, with a black crescentic spot in front of the eye and a white spot below it, the upper tail-coverts are white; the tail is light gray, with a broad subterminal band of dusky; the under parts are pure white, or rarely tinged with rosy.

The postjuvenal molt begins early in September and by November or December the first winter plumage is fully acquired by a partial molt, which involves everything but the wings and tail. The forehead is now largely white and the under parts are entirely so. The crown and occiput are mottled with dusky, the markings coalescing into a solid, slate-colored, nuchal collar, including the orbital and auricular regions; and the back is clear "gull-gray." This plumage is worn all winter until a *complete* molt occurs in May or earlier, which is practically a prenuptial and a postnuptial molt combined. This is a very peculiar molt, for, so far as I know, no other gull molts its wings and tail so early in the spring. I have seen at least six birds with the primaries in full molt in May, and fully as many in fresh plumage that had completed the molt in June. Although the birds do not breed in this plumage, I suppose we may as well call it a first-nuptial plumage. It is characterized by a partial, black hood, the head being mottled black and white. There is much individual variation, but usually the black predominates above and the white below; the outer primary is black, with a broad whitish wedge extending more than halfway up the inner web. The black decreases on each succeeding primary inwardly until it nearly or quite disappears on the innermost, which is largely "gull-gray." All the primaries are white-tipped; the tail is usually like the adult, but sometimes has a few dusky shaft streaks near the end. There is a slight roseate suffusion on the breast in this plumage. Perhaps the flight feathers are not molted again that year, but undoubtedly the plumage of the head is replaced by the winter plumage like that of the adult, and perhaps the wings may also be molted again during the late summer or fall. I have been unable to trace into subsequent plumages the peculiar wing acquired during the first spring, nor do I know when it is replaced.

The next step toward maturity we find in birds in both nuptial and winter plumages in which the plumage is fully adult except the primaries. This is undoubtedly the second year plumage, and the inference is that it is acquired at a complete postnuptial molt when the bird is a little over a year old, which means that the two complete molts are only about six months apart. In this plumage the primaries are black for a distance of about 3 inches from the tip on the outer and for a decreasing distance on each succeeding primary. The tips of all the primaries are white, sometimes for an inch or so on the outer, and sometimes there is an indistinct white spot in the black of the outer primary. At each succeeding molt the black in the primaries decreases and the white increases until only a small black area remains on each primary. There is apparently much individual variation in the extent and rapidity of this change.

The complete postnuptial molt of adults occurs mainly in August and September, but it is often not completed until October. The outer primaries are the last to be renewed. Winter adults have the forehead, lores, and throat white, and the occiput, cervix, loral, and auricular regions densely mottled or washed with slate gray. The beautiful nuptial plumage is acquired by a partial or perhaps a complete prenuptial molt in April and May.

Food.—The food and feeding habits of the Franklin's gull demonstrate its value to the agricultural interests of the west, and prove that it is almost wholly, if not entirely, beneficial to mankind. During the nesting season, at least, its food is almost wholly insectivorous.

Doctor Roberts (1900) says of its food at this season:

> The stomachs and gullets of several birds collected by the writer and kindly examined by Professor Beal, of the Biological Survey at Washington, contained a mass of insect débris to the exclusion of all else. One stomach alone furnished some 15 different species, among them several varieties injurious to the interests of man. The chief part of the food, however, during the time of our visit to the colony, and that on which the young were largely fed, was the nymphs of dragon flies, which were then to be found in immense numbers in the meadows near by. The writer counted no less than 327 of these insects in a single stomach.

Early in the spring, when the farmers are plowing, these gulls follow the plow in large numbers, contending with the blackbirds

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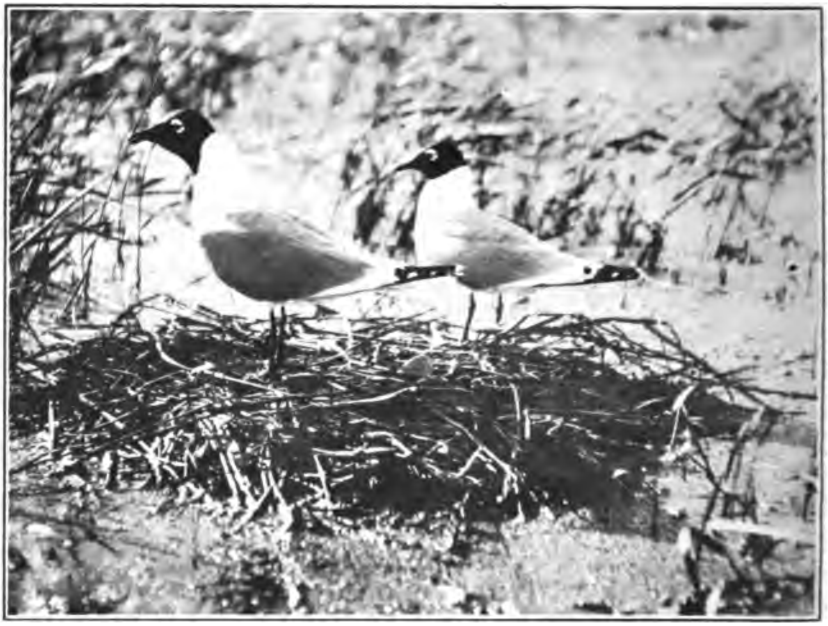

North Dakota. H. K. Job.

Lake of the Narrows, Saskatchewan. H. K. Job.

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and other birds in picking up from the freshly turned furrows quantities of angleworms, cutworms, and other grubs and larvae. Later in the season they resort to the prairies and grass fields to feed on grasshoppers and locusts, many of which are caught on the wing. I have seen them hovering over the water in open sloughs and small ponds and daintily gathering bits of food from the surface which probably consisted of aquatic insects or their larvae, and possibly a few small fish. I have also seen them coursing low over the meadows like large swallows, catching mosquitos and other small insects in the air. I once saw a great cloud of them flying over a large marshy area in the interior of an island in Lake Winnipegosis. They were so thick and so much excited that I thought it must be a nesting colony, but on investigation I found that they were feeding on the swarms of gnats, flies, and other minute insects that were rising from the bushes in long swaying columns like clouds of smoke. The air was full of dragon flies which were preying on the same insects, and probably the gulls were feeding on them also.

Mr. John F. Ferry (1910) states that the stomachs of three birds taken in Saskatchewan contained remains of numerous midges and Acrididae, a spider, a small mole cricket, a water beetle, and several large dragon-flies.

Behavior.—In flight the Franklin's gull is as light and graceful as at other times. When traveling long distances, as it does regularly, to and from its feeding grounds, it proceeds rather swiftly, with constant flappings in widely scattered and open flocks at a moderate height. When rising from or alighting on the water or ground its feet are allowed to dangle, but ordinarily they are stretched out behind and partly or wholly concealed under the feathers. At times small parties indulge in aerial exercise or sport by soaring upward in spiral curves, sailing on outstretched, motionless wings, mounting higher and higher, until almost lost to sight. Large numbers gather regularly at certain spots apparently for the sole purpose of performing these aerial evolutions, and after an hour or so of such exercise they suddenly disappear, as mysteriously as they came, drifting aimlessly about in roving bands. If one of their number is shot they gather immediately into a dense, hovering screaming flock, darting down toward their fallen companion, but if no more are killed they soon lose interest and silently drift away.

The Franklin's gull swims with exquisite grace and buoyancy, floating lightly on the surface. About its breeding grounds it is very tame and many a beautiful picture is seen of a party of these lovely birds, resting on the placid water of some small marshy pool, the delicate colors of their spotless plumage clearly reflected in its glassy surface and offset by a background of dark green reeds.

My field notes describe the ordinary note of this gull as a soft "Krrruk" or a low clucking call. This is sometimes varied with a louder and more plaintive cry, sounding like "pway" or "pwa-ay," which is rather musical; and when much excited or alarmed, as on their breeding grounds, it utters loud, shrill, piercing screams. Mr. Thomas Miller, in a letter to Major Bendire, described its notes as follows:

> While feeding, their call is a shrill "Kuk Kuk Kuk Kuk" repeated incessantly, varied at times with their characteristic "Weeh-a Weeh-a," the first syllable prolonged and uttered with the rising inflection. This is the call most commonly heard, and while flying home from feeding about the only one they use. In visiting the breeding place they hover over you and repeat this call with a mournful cadence, as if imploring you not to molest their nests. Then their cries are incessant and can be heard a long way off. On bright sunny days in May and June they soar in the air to a great height, so high as to be scarcely visible, when they swoop back and forth crying "Weeh-a Weeh-a Weeh-a Po-lee Po-lee Po-lee Po-lee." The last notes are invariably uttered shorter and quicker than the first. They will fly thus all day long and the note "Po-lee Po-lee" is only heard when they are soaring at a great height during fine weather. This note is not unlike that heard on the Scottish moorlands while the whaup or sickle bill curlew is circling around the lonely traveler.

Mr. J. W. Preston (1886) says that "at intervals they utter a shill, clear cry much resembling the call of the marbled godwit. Their ordinary note is a loud, mewing cry, uttered in a short, jerky, impatient manner, somewhat resembling the mewing of a cat. This call is constantly kept up, and when they congregate at their rookery in the evening the din is deafening, and may be heard all night during the mating season, which begins about May 1 and lasts until the 15th of the month. Regularly at dark a large portion of the flock took their noisy way to the open lake, where they remained on the water until light."

Franklin's gulls are not only highly gregarious among themselves, nesting in compact colonies of immense numbers, but they are decidedly sociable toward other species, especially on their breeding grounds. In the sloughs where they breed they have for intimate neighbors large numbers of yellow-headed blackbirds, black terns, coots, rails, grebes, canvasbacks, redheads, and ruddy ducks, with all of whom they seem to be on good terms. They seem to be particularly intimately associated with eared grebes. There is almost always a colony of these grebes in or near every Franklin's gull colony, and often the nests of the two species are closely intermingled. Mr. Herbert K. Job has a photograph of a Franklin's gull eating the eggs in an eared grebe's nest, but I doubt if they regularly disturb the nests of their neighbors to any great extent, although nest-robbing is a trait peculiar to almost all gulls. Mr. Preston (1886) says of their behavior:

> While defending their nests they evince great courage and spirit, successfully routing the Canada goose (*Berniola canadensis*), white pelican (*Pelecanus erythrorhynchus*), and other large birds which chanced to molest them. A most distressing sight was the determined but unsuccessful attempt of a dozen frightened gulls to chase a large snapping turtle from a nest on which it had killed the mother bird and was leisurely devouring her eggs. When I approached the nest the owners, with a few others, hovered about crying piteously, almost striking me with their wings.

Fall.—After the breeding season is over these gulls gather into immense flocks and wander about in search of suitable feeding grounds, where they must prove of great benefit in destroying vast hordes of injurious insects, such as locusts and grasshoppers, which are swarming on the prairies during the latter half of the summer. Mr. George Atkinson, according to Macoun (1909), says of their abundance at that season:

> While driving into the Eagle hills, about 40 miles west of Saskatoon, on July 30, 1906, we passed an extensive mud flat and salty slough, on which rested between four and five solid acres of gulls. I fired a shot into the air to note the effect and they rose as one bird in such a cloud that their wings clashed together in a frantic flapping and their discordant cries were almost deafening. It would be entirely impossible to estimate the number of birds in this flock.

Dr. Thomas S. Roberts has sent me the following interesting extracts from his field notes on the behavior of Franklin's gulls in the great autumnal gatherings of this species in Minnesota:

> Immense numbers of these gulls spend the nights out in the open lake, congregating to form one or two or sometimes three flocks, 600 or 800 feet long and 200 or 300 feet wide. The gulls sit close on the water, so that from a distance they look like vast "banks" of ducks, except when the sun strikes them just right, then they show white. During the day the gulls feed on the fields and prairies at some distance from the lake, returning toward evening in various sized flocks and assembling out in the lake for the night. About sunrise in the morning they begin to stir, and for a time there is great commotion among them. Soon they get up in a body and the air is filled with them. As the slanting sun strikes their snowy bodies and slowly moving wings it is a curious and beautiful sight, appearing as though the air were filled with huge snowflakes or eddying bits of silver tinsel. Rising to some distance above the water they start for their feeding grounds in a great straggling company, the head of the flock soon becoming V-shaped as geese fly. Later they break up into numerous smaller flocks, each flying in more or less perfect V-shaped formation. They return at night in the same way or in broad straight-fronted flocks, and when the light makes them appear dark the inexperienced sportsman is apt to think a tempting flock of small geese is approaching. They fly too slowly for ducks.
>
> On October 4 at 5 p. m. the gulls came from the north at a great height, circling around against the blue sky, appearing like shining white specks as the sun struck their white bodies. The wings were invisible, but their movements caused a flickering or twinkling, causing the gulls to look like stars in the deep

blue sky; as they darted about or dropped suddenly the effect was that of shooting stars. I lay on my back on the bank for some time watching them. As they reached a point over the lake they descended by a series of sudden downward shoots or more frequently by a gentle spiral.

From the southeast the gulls came in immense flocks, low down, larger than I have seen before. At times the stream seemed to extend for what appeared about a mile and was at places dense and broad, at others thin. But the number of gulls was something beyond calculation; it reminded one of the way wild pigeons used to fly. As they approached the water they dropped near the surface and swept up the lake in great clouds to join the great concourse already assembled. This flight of gulls is something that never ceases to interest me; they are in such vast numbers, so regular in their habits, and so beautiful.

October 5. The gulls left the lake this morning going northward between 9 and 10. Many flew out in flocks directly, but I noticed a new performance. Over the lake a hundred or more gulls would get together and begin to fly about rapidly in a circle, and, others joining them, there was soon formed a great whirling mass of gulls, the birds moving in all directions within the globe, but turning about when reaching its limits. It was a curious sight, especially as at times five or six of these great whirligigs would be in view at the same time. It was a great game and presented a spectacle of perfect abandon. Fresh flocks encountering one of these merry-go-rounds either passed directly through it or more often joined at once in the sport. Round and round and up and down they went, forming a great whirling mass, which, as a whole, wound slowly onward away from the lake. Sometimes two of these eddying groups encountered each other, and then they merged to form a single one. They broke up finally by the gulls that tired first steering away in the direction of the flight until all had gone. I lay beside a haystack in the warm sun for an hour watching this gull play. The masses formed directly in front of me and passed over and by me at a height of 75 to 100 feet. It reminded me most of the revolving balls of gnats or other insects one sometimes sees on still evenings. The morning was clear, warm, and only a moderate breeze blowing from the north.

DISTRIBUTION.

Breeding range.—Prairie regions of the northern interior. East to central Manitoba (Shoal Lake) and western Minnesota (Becker and Jackson Counties, Heron Lake). South to northwestern Iowa (Dickinson County, formerly), northeastern South Dakota (Brookings, Clark, and Marshall Counties), southwestern Saskatchewan (Crane Lake region), and northern Utah (Bear River). West to southeastern Alberta (Many Island Lake). North to central Saskatchewan (south and east of the Saskatchewan River) and central Manitoba (Waterhen Lake).

Winter range.—A few birds winter in the Gulf of Mexico from the coast of Louisiana to Panama, on the west coast of Mexico (Mazatlan) and Guatemala (Chiapam); but the main winter range is on the west coast of South America, from northern Peru (Payta) to Patagonia and southern Chile (Magellan).

Spring migration.—Northward by the most direct route. Dates of arrival: Minnesota, Heron Lake, average April 4 and earliest March

27; Manitoba, Aweme, average April 25 and earliest April 8; Saskatchewan, Indian Head, average May 3 and earliest April 25. Transient dates: Missouri, April 20 to May 15; Kansas, April 10 to June 9; Iowa, April 6 to June 27. Late dates of departure: Peru, Callao Bay, April 11; Guatemala, Champerico, May 30; Texas, Kerrville, May 17 and Aransas Bay, June.

Fall migration—A reversal of the spring route, but more erratic. First arrivals reach Chile, Valparaiso, in September. Late dates of departure; Minnesota, Madison, October 8; Iowa, November 6; Nebraska, Lincoln, November 17; Texas, Brownsville, November 10.

Casual records.—Has wandered on migrations to Hudson Bay (specimen in British Museum from Hayes River); Pennsylvania (Philadelphia, October 22, 1911); Virginia (Blacksburg, October 24, 1898); the West Indies (St. Bartholomew Island); California (Hyperion, October 17 and November 24, 1914); and many other inland localities. Accidental in Hawaiian Islands (Mauai, winter).

Egg dates.—Minnesota and North Dakota: Forty-two records, May 3 to June 26; twenty-one records, May 18 to June 4. Manitoba and Saskatchewan: Twenty-one records, June 5 to 16; eleven records, June 6 to 11.

LARUS PHILADELPHIA (Ord).

BONAPARTE'S GULL.

HABITS.

This widely distributed American species is found at some season of the year in nearly all parts of our continent. As it retires to the northern wooded regions of Canada to breed, it is familiar to most of us only as a migrant or a winter visitor, and few naturalists have studied it on its breeding grounds. During the first warm weather in April, when the shad and herring are beginning to run up our rivers, we begin to see the migrating flocks of this pretty little gull moving northward along our coasts or up the valleys of our great rivers in the interior. They proceed in a leisurely manner, drifting along in loose flocks, as if aimlessly wandering, stopping to dip down and occasionally pick some morsel of food from the surface of the water, chattering to each other in soft conversational notes, or coursing over the meadows and marshes to catch the first flying insects of spring. The black-headed adults make up the vanguard of the migrating hosts, followed later by the immature birds; flocks of young birds, however, often have one or two adults with them as leaders. Sir John Richardson (1851) says:

> This species arrives very early in the season, before the ground is denuded of snow, and seeks its food in the first pools of water which form on the borders of Great Bear Lake, and wherein it finds multitudes of minute crustacean animals and larvae of insects.

Nesting.—I have never succeeded in finding its breeding grounds and must quote from what scanty accounts of its nesting habits have been published. Mr. Roderick MacFarlane (1891) writes:

> Thirty-seven nests are recorded as having been taken, with eggs in them, between 10th June and 10th July, in the wooded country in the neighborhood of Fort Anderson and on Lower Anderson River. They were all built on trees at various heights (from 4 to 15 and even 20 feet) from the ground, and, with one exception, which was composed of down and velvety leaves held together by some stringy turf, they were made of small sticks and twigs lined with hay and mosses, etc. The parents always fly about in close proximity to the nest, and scream vehemently when explorers, in the interests of science, are obliged to deprive them of their eggs or young, and not infrequently shoot one of them. They seldom lay more than three eggs.

The following account is published by Baird, Brewer, and Ridgway (1884):

> Mr. Kennicott found this gull nesting in the neighborhood of Fort Yukon, and describes the nest as being of about the size of that of *Zenaidura carolinensis;* but the cavity is rather deeper. It was placed on the side branch of a green spruce, several feet from the trunk, and about 20 feet from the ground, near a lake. Mr. Kennicott saw several nests near this one, all alike and in similar positions, except that some were not over 10 feet from the ground, and were on smaller trees; but all were on spruce trees. One nest which he examined contained three young birds of a dirty yellowish color, thickly spotted with dark brown. He saw between 25 and 50 gulls about that breeding place, but he found only a few of their nests. These birds were said by the Indians always to breed in similar situations.

This species apparently bred formerly as far south as Michigan and Wisconsin, in the region of the Great Lakes. Mr. W. H. Collins (1880) was told by hunters living at St. Clair Flats that Bonaparte's gulls bred "in Baltimore Bay and the North Channel, and that they lay their eggs on old logs with no signs of a nest." Kumlien and Hollister (1903) write:

> In 1880 a few were said to breed on Chambers Island, Green Bay, and we saw on some small islands in Big Bay de Noquet, Michigan, a number of nests like pigeons' nests on the flat branches of low coniferous trees that without question had been used by these birds.

Eggs.—The Bonaparte's gull lays from two to four eggs, ordinarily three, frequently only two, and rarely four. The eggs somewhat resemble those of the Franklin's gull, but are considerably smaller. In shape they are ovate, pointed ovate, or pointed elongate ovate. The ground color varies from "buffy citrine" or "Dresden brown" to "dark olive buff" or "deep olive buff." They are more or less evenly spotted or irregularly blotched, rarely scrawled, with various shades of brown, "brownish olive," and "brownish drab," too numerous and variable to be definitely named. The measurements of eggs, in various collections, average 49.5 by 34.9 millimeters; the eggs showing the four extremes measure 54 by 37, 50.6 by 38.2, 44.5 by 35, and 47 by 32.5 millimeters.

Plumages.—I have never seen the downy young of the Bonaparte's gull, but Dr. Jonathan Dwight (1901) describes it as "much like that of *Sterna hirundo*, yellowish with dusky mottling above." He describes the juvenal plumage as follows:

> The upper surface is decidedly brown, with paler edgings; a blackish brown band extends along the cubital border of the wing into the tertiaries; the secondaries have dusky markings; the primaries show little white, their coverts being partly black, and the tail is white with a broad subterminal black band, the rectrices being tipped with buff. The sides of the head are white with a dull black auricular patch and an anteorbital spot, and the rest of the lower parts are white with a brownish wash on the sides of the neck and breast. The bill and feet are black.

This plumage is partially replaced, in September and October, by the first winter plumage, the molt involving only the contour feathers. "A blue-gray mantle and paler head are assumed," but the wings and tail of the juvenal plumage are retained. A partial prenuptial molt, involving mainly the head and neck, possibly some of the body plumage, takes place during March and April. At this molt most specimens merely renew the first winter plumage on the head, but some birds acquire a partially black head. In some birds the head is only slightly mottled above, but in others the deep plumbeous hood of the adult nuptial is more or less complete. Young birds can always be readily distinguished, even at a distance, by the broad, dusky, subterminal band on the tail and by the color pattern of the wings. The dusky cubital band is always in evidence, though often much faded, in the lesser wing-coverts. The scapulars are largely dusky, the greater wing-coverts partly so, and all the remiges are broadly tipped with dusky. The three outer primaries are also dusky on the outer web and for a narrow space on the inner web, next to the shaft, on the outer two.

A complete postnuptial molt occurs in summer, beginning in July or August and lasting sometimes until October, at which the adult winter plumage is assumed, with the pure white tail and the white, black-tipped primaries. Adults have a partial prenuptial molt, as in young birds, and a complete postnuptial molt in summer. I have examined adults in full winter plumage as late as March 17 and molting into nuptial plumage at various dates from March 30 to May 15. I have seen specimens taken on the Pacific coast in full nuptial plumage on November 6 and December 2, but ordinarily the postnuptial molt begins in August and is completed in October; usually the flight feathers are molted last.

Food.—Like its larger relative, the Franklin's gull, the Bonaparte's gull is largely insectivorous. Over the marshy ponds of the interior flocks of these pretty birds are frequently seen beating back and forth, adroitly catching insects on the wing, and their stomachs are often packed full of such food. Many insects are gleaned from the surface of still pools or picked up from the drift rows of decaying vegetation along the shores. Mr. Arthur H. Norton (1909) says that in Maine it "has been found feeding over rafts of drifting seaweeds, when its diet was found to consist of maggots, probably *Coleopa frigida*—a fly that breeds at high-water mark in decaying seaweeds (*Algae* and *Zostera*)." Nuttall (1834) examined two that "were gorged with ants and their eggs, and some larvae of moths in their pupa state." On the seacoast they live on small fish, shrimps, and other surface-swimming crustaceans, marine worms, and other small aquatic animals. Apparently very little, if any, vegetable food is taken.

Behavior.—The flight of this species is very light and buoyant, as well as active and graceful. It is more tern-like than gull-like, and it might easily be overlooked in a flock of loitering terns. When moving about looking for food its flight seems listless and desultory; every stroke of its long wings lifts its light body perceptibly, as it drives it along much faster than it seems. Like snowflakes wafted by the wind the loose flock drifts along; one hardly realizes that it has come before it has swept away beyond our vision. Yet with all this apparent listlessness there is no lack of the power of control; it can breast the heaviest storms, it can rise and fall over the crests of the largest waves, and can go whither it will with the utmost ease and grace. It swims with equal buoyancy and grace, resting on the surface as lightly as an eggshell. I have sometimes seen it dive, though its food is often picked up while it is swimming on the surface; but more often it drops lightly down in the air, picking the morsel from the water with its bill and perhaps touching the surface with its feet.

Its voice is not powerful, but when feeding in flocks it is often quite talkative. Doctor Townsend (1905) says that "occasionally it emits a harsh, rasping cry, but as a rule it is silent." Neltje Blanchan (1898) describes its note as "a plaintive shrill, but rather feeble cry, that was almost a whistle."

Fall.—Of the fall migration of this gull in Ohio, Prof. Lynds Jones (1909) writes:

> In my experience this gull is far more numerous on both sides of Cedar Point sand spit than elsewhere along the lake, and the times of maximum numbers occur between November 1 and December 30. During the last three winters I have found a flock of from 50 to 500 birds ranging along the shore of the sand spit as long as there remained open water, which was well into January. They act much like terns diving headlong into the water for fish, but can always be readily distinguished from them by the almost sparrow-like conversational notes instead of the harsh ter-r-r of the terns. They seem to prefer the vicinity of

the lake beach to the marshes for feeding grounds, possibly because small fish are more numerous there. On the occasions when the pent-up swamp waters at Rye Beach have broken through into the lake carrying all sorts of débris upon their floods, these gulls have collected at the place in great numbers, feeding.

Winter.—Bonaparte's gull also winters to some extent along the whole of both coasts of the United States, though rather rarely northward and much more abundantly southward, where it is associated with nearly all of the other common species. At this season it frequents the bays, harbors, and tidal estuaries, where it can find small fry to feed upon. I know of no prettier, winter, seashore scene than a flock of these exquisite little gulls hovering over some favorite feeding place, plunging into the cold gray water, unmindful of the chilly blasts and the swirling snow squalls.

DISTRIBUTION.

Breeding range.—Known to breed at only a few localities in the timbered regions of the northwest. East in Mackenzie to the Anderson River, Great Bear Lake (Fort Franklin) and Great Slave Lake (Forts Fae and Resolution) and on Southampton Island. South in British Columbia to the Cariboo District (Quesnelle Lake). West in Alaska nearly to the northwest coast (Nulato and Kowak River). North to the limit of trees. Adults, in breeding plumage, occur in summer more or less regularly as far south as the Gulf of St. Lawrence (Cape Breton and Magdalen Islands), some of the Great Lakes (Lake Michigan), and Saskatchewan (Quill Lake), which suggests that they probably breed far south and east of the known breeding places.

Winter range.—On the Atlantic coast regularly from South Carolina southward, more rarely farther north, straggling as far north as Maine. Frequently in Bermuda. On the Gulf coast from Alabama and Louisiana southward to Yucatan (Progreso). On the Pacific coast from Washington (Gray's Harbor) southward as far as central Mexico (Jalisco), rarely to Peru.

Spring migration.—Northwestward from the Atlantic coast to the interior. Early dates of arrival: Pennsylvania, Erie, April 13; New York, April 21; Prince Edward Island, May 10; Quebec, Godbout, April 27. Late dates of departure: Florida, Coronado, April 9; South Carolina, Charleston, May 15; District of Columbia, May 30; Pennsylvania, Erie, May 25; New York, June 14; Massachusetts, June 9. Dates for the interior: Louisiana, New Orleans (latest), March 25; Kansas (average), April 21; Michigan, Ann Arbor (average), April 19; Manitoba (average), April 24; Mackenzie, Fort Resolution (average arrival), May 14, and Fort Simpson, May 12 to 22; California, Monterey, rare after May 18, latest June 2; British Columbia, transients passing from April 11 to May 24.

Fall migration.—Southeastward to the Atlantic coast *via* James Bay and the Great Lakes. Early dates of arrival: Gulf of St. Lawrence, August 4; Massachusetts, August 13; South Carolina, Charleston, August 20; Florida, Coronado, September 16. Late dates of departure: Quebec, Montreal, October 1; Gulf of St. Lawrence, November 25; Massachusetts, December 23. Late dates of departure in the interior: Manitoba, October 24; Minnesota, Aitkin, November 2; Nebraska, Lincoln, November 3; Missouri, Jackson County, December 8. On the Pacific coast early arrivals reach California, Los Angeles County, August 20. Late birds recorded in Alaska, Unalaska, October 5.

Casual records.—Accidental on Laysan Island (December 27, 1912), on Heligoland (winter, 1845), and in Great Britain (8 or 10 records).

Egg dates.—Anderson River region: Twenty records, June 10 to July 5; ten records, June 17 to 23.

LARUS MINUTUS Pallas.

LITTLE GULL.

HABITS.

Contributed by Charles Wendell Townsend.

The little gull is appropriately named, for it is the smallest of all gulls, being but 11 inches in length. Bonaparte's gull, one of the next smallest gulls, averages 3 inches longer. Although a native of Europe and Asia, breeding in the northern parts and wintering as far south as the Mediterranean, it deserves a secure place in the American avifauna, as there are several authentic records of its occurence in this country and others which are reasonably certain. The first is mentioned by Swainson and Richardson (1831), who say:

> A specimen obtained on Sir John Franklin's first expedition was determined by Mr. Sabine to be a young bird of the first year of this species, exactly according to M. Temminck's description.

According to Baird, Brewer, and Ridgway (1884), one was obtained at Bermuda on January 22, 1849, by Major Wedderburn, and another one was killed in the following month; also specimens were obtained near Mazatlan, on the western coast of Mexico, in 1868 by Colonel Grayson. The first thoroughly authentic specimen is recorded by Dutcher (1888) of a bird shot by Robert Powell at Fire Island, Long Island, New York, about September 15, 1887. The specimen is now in the American Museum of Natural History. A second specimen, now in the Museum of the Brooklyn Institute of Arts and Sciences, was shot by Mr. Robert L. Peavey in a flock of Bonaparte's gulls at Rockaway Beach, Long Island, on May 10, 1902, and recorded by Braislin (1903). The last recorded specimen is one taken at Pine Point, Scarborough, Maine, on July 20, 1910, that fortunately fell into the hands of Mr. Arthur H. Norton (1910), who has also brought together all the evidence for its occurence in America.

Nesting.—In the neighborhood of the Baltic this gull breeds in marshes and nests on grassy knolls and floating islets of tangled plants. The nest is made of leaves and grass. Three eggs constitute a set, although sometimes four and rarely five are laid. The eggs vary in color from yellowish-brown and olive brown to greenish-gray, marked with spots and blotches of reddish brown and gray. They are considerably smaller than those of the Bonaparte's gull and measure 1.66 by 1.25 inches Meves, quoted by Dresser (1871), says that both the nest and eggs resemble closely those of *Sterna hirundo* that nested among them. He found, however, that the yolk of the little gull's egg was of an orange-red color, while that of the common tern was ocher-yellow. Both parents incubate.

Plumages.—In the juvenal plumage the upper parts are mottled with dark brown, and there is a band of the same color at the tip of the tail; the bill is blackish and the feet yellow. In the adult nuptial dress this bird, like the Bonaparte's gull, has a black hood. The mantle is pale gray, the underparts suffused with pink. The primaries are tipped with white, dark below; bill reddish brown, feet vermillion. The adult in winter loses the black hood and the head and neck are white, brownish gray on the occiput; there is a dusky spot in the auricular region. In many ways it resembles Bonaparte's gull, but lacks the broad black anterior and posterior margin to the wings. Norton (1910) sums up the distinctive marks of its plumage as follows:

> The adults are distinguished at once by the broad white posterior border of the wing without black, the pale pearl gray mantle, and the slaty lower surface of the wings. The young, by the inner vanes of the outer primaries being chiefly white; the inner primaries with both webs gray, their tips white, the white increasing in length as it proceeds in, and without black subterminal areas. Moreover, it is the smallest known gull.

Food.—Dresser (1871) quotes Meves as to their feeding habits, as follows:

> I found in the stomachs of many of the little gulls I examined not only insects but chiefly small fishes, which they are continually catching in the lake. Very few had insects in their stomachs; but it is probable that later, when the *Neuroptera*, *Phryganiae*, and *Ephemera* are more abundant, they feed on these in preference, as is the case with the black-headed gull (*Larus ridibundus*). Others have found *Neuroptera* in their stomachs.

Behavior.—In flight and general habits the little gull is said to closely resemble the black-headed gull. They are very tame and fearless of danger. Their flight is graceful and active, and it is said at times to be butterfly-like or to resemble that of swallows. Professor Liljeborg, quoted by Dresser, says that their graceful and quick evolutions in pursuit of insects "almost surpass goatsuckers." In a word, these gulls resemble terns in flight rather than the larger gulls.

Fall.—Gätke (1895), at Heligoland, says:

> All the gulls leave their northern breeding stations before the approach of winter in order to betake themselves to more temperate latitudes. In the case of none, however, does this movement so much partake of the nature of a true migration as in that of the present species. Long-extending flights of these pretty little birds may be seen traveling over the sea past the island at the close of September and during the first half of October. Their movements, however, are quite different from what one is accustomed to see in the case of most migrants. Companies of from 100 to 200 individuals travel in motley throng quite low over the sea, continuously dropping to the surface to pick up food. All the time, however, they rigidly maintain their western course of flight, and speeding along with great rapidity are very soon lost to sight. Moreover, considerable quantities of these gulls, intermingled with the larger species, are met with here all the winter months during violent westerly and northwesterly gales, when they seek a temporary shelter on the lee side of the island. While roving over the sea in all directions in search of food they execute many rapid beats with their wings.

Winter.—Canon Tristram writes to Dresser (1871) that "*Larus minutus* abounds in winter on all the shallow lagoons of the North-African coast, especially between Tunis and Carthage, where it is extremely tame, flying and dipping after small fish like a tern."

DISTRIBUTION.

Breeding range.—Iceland, Northern Europe, and Asia, from Jutland, Prussia, Gothland, and the northern half of Russia, eastward across Siberia to the Sea of Okhotsk, and northward to Archangel and to the Arctic Circle on the Obi River.

Winter range.—South to north Africa coasts, the Mediterranean Sea, and inland waters of southern Europe; occasional in Great Britain.

Casual records.—Two records for Long Island, New York (Fire Island, September 15, 1887, and Rockaway Beach, May 10, 1902); two for Maine (St. George, August 12, 1904, and Scarborough, July 20, 1910); and two for Bermuda (January 22 and February, 1849). Accidental in northern India and in Faroe Islands.

Egg dates.—Northern Europe: Nine records, May 23 to June 16; five records, June 4 to 11.

RHODOSTETHIA ROSEA (Macgillivray).

ROSS'S GULL.

HABITS.

The rosy gull is not only the most beautiful of the gulls but it is the most strictly Arctic, one of the rarest in collections and, to all but a favored few, the least known. Owing to its restricted habitat in an inaccessible region, few of us may ever expect to see it. As its wanderings carry it over a wide area in Arctic regions, a few specimens have been picked up by Arctic explorers. For nearly all that we know of its habits we are indebted to the Russian explorer and good ornithologist, Dr. Sergius A. Buturlin (1906), who, during his visit to the Kolyma delta, on the Arctic coast of eastern Siberia, in 1905, collected 38 skins and 36 eggs of this beautiful bird. Fortunately he has given us a very full and interesting life history of this species, from which I shall quote freely.

> The delta of the Kolyma, which is the easternmost of the great rivers of the North Polar basin, lies, roughly speaking, between 68½° and 69¾° N. lat. and from 159° to 161½° E. long. This vast area, at least 15,000 square kilometers in extent, consists of a liberal admixture of lakes, lagoons, channels, rivulets ("viska"), swamps, moors, and damp ground of every description, with dry places only at intervals. The southern part of this delta, some one-third or even less of the whole, is covered by forests. The other parts stretch beyond the northern limit of the forests, but are for the most part covered by extremely dense and well-grown bushes of *Alnus incana* (ordinarily 5 to 10 feet high, but occasionally reaching a height of 15 feet with a thickness of from 5 to 6 inches), and by various species of *Salix*. The traveler must go some 20 kilometers from the main channels of the great river, and then perhaps 2 or 3 kilometers from the rivulet or "viska" along which he is advancing, to find a little piece of true "tundra" such as I have seen on Kolguev Island, with lichens covering the ground, tiny bushes of *Betula nana*, and different *Salices* studded over the drier spots, and mosses and *Carices* clothing the damp portions.

Spring.—After a period of very cold weather during the first half of May he describes the breaking up of winter, the coming of the earliest birds, and the arrival of the Ross's gulls on their breeding grounds, as follows:

> Toward the middle of May the weather became somewhat better, and the snow melted at midday (freezing again, of course, in the shade), so that on the southern slopes and sandy islands the soil made its appearance. At this time the first specimens of geese (*Anser serrirostris*, *A. gambeli*, and in small numbers *A. rhodorhynchus*), and even swans (*Cygnus bewicki*) made their appearance, migrating down the river; while about May 20 small parties of them passed. *Linota exilipes*, *Plectrophenax nivalis*, *Corvus orientalis*, the white-tailed eagle, and *Lagopus albus* (partly wintering in the district) had of course long been present. Then migration stopped, and snowstorms began again until May 27. That day was fine, with only some 3°-6° cels. of frost,

so that the snow melted in the hot sun, and on this and the following days geese, swan, ducks, gulls (*Larus vegae* and (?) *L. glaucescens*), and waders (especially *Tringa maculata*, *T. subarquata*, *T. sakhalina*, *Phalaropus fulicarius*, and *Charadrius fulvus*) migrated in great numbers. At last, on May 30, it rained, while the thermometer varied between 16° cels. above zero and as much below; snow became scanty on the open places, and the first rosy gull was reported. On the morning of May 31 one of my men saw a pair, and during the day I went on the river, where the fathom-thick ice was still quite safe, and came across several dozens. The sun was shining brightly, and in the distance each pair appeared like so many roseate points on the bluish ice of the great stream. I say "pair," as from their first arrival the birds were constantly seen in pairs. They had evidently just finished their migration and were tired after their exertions, for they sat very quietly on the ice, and though all attempts to stalk them were unavailing, they would not fly far, but only shifted from place to place with a lazy and somewhat uneasy motion of their wings, which made me jot down in my notebook on the spur of the moment that the flight was more fulmar-like than gull-like.

Courtship.—Although most of the birds seemed to be paired on their arrival, he noted some squabbles with unmated males and the following courtship performance:

Every now and then the male tried to express his feelings to his mate by pecking her curiously, as if trying to kiss her, with his open beak on her head or neck, or made a few steps round her to one side or the other, showing off as some pigeons do; then with a sound like *trrrrrr* lowered his neck and breast to the ground, and in this position, with all the hinder part of the body, the tail, and the ends of the folded wings high up in the air, continued for some seconds his little promenade before the female, who very rarely engaged in such antics.

Nesting.—He

found the rosy gull nesting in little colonies of from 2 or 3 to 10 or 15 pairs, in company with the common black-capped tern of the delta, which, however, in nearly every case exceeds it in numbers. A pair or two of *Totanus fuscus* nearly always breed with them, and not unfrequently *Colymbus arcticus* and *Fuligula glacialis*, sometimes accompanied by the white-winged gull (*Larus Glaucescens*), and a pair or two of *Squatarola helvetica*. A little low island in a lake is usually selected for the breeding place, and this made the nests very difficult of access, as until the last days of June a boat can only be used near the banks and must be then dragged over the ice, which is exceedingly slippery and generally unsafe after June comes in, especially near the islands, as I found to my cost. One of the colonies, however, was on a piece of wet tundra near two lakes, a square kilometer in extent, covered with a labyrinth of pools of snow water from 2 to 6 or even 10 inches deep, but practicable in wading boots, thanks to its floor of everlasting ice beneath the underlying mud. Between these pools, which were from 15 to 50 feet in diameter, were pieces of very wet ground covered with *Carices*, damp mossy spots, and even tiny patches of comparatively dry bog covered with lichens or *Betula nana*.

In this colony I found 10 nests of *Rhodostethia*, placed, among those of the tern, on little mossy swamps almost bare of grass, evidently because the more grassy places were too wet and unsafe. But in the remaining colonies the state of affairs was otherwise; there the tern nested on the moss (sometimes making no nest at all), and laid its one or two eggs much nearer to the dry parts of the little islands, which were perhaps a hundred yards long and from 10 to 20 yards wide, while the rosy gulls made their nests on wet grassy spots or bogs much nearer to the water, and these nests rose from 4 to 10 inches, generally from 5 to 8 inches, above the surface. The hollow formed in the grass (dead grass, of course, as green grass is hardly seen even by the 20th of June) is about 6 or 7 inches in diameter; but the nest proper is a shallow cup only about 4 or 4½ inches in diameter. It is composed of dry grass and *Carices*, sometimes with the addition of a few dry *Betula* or *Salix* leaves, while I once saw one made of white reindeer moss. The cup of the nest is from ⅛ to ¼ inch, generally ¼ inch thick.

The eggs which he collected were taken between June 13 and 26, those taken on the latter date being nearly ready to hatch.

Later on (July 6 and 7) he discovered two more colonies, which he describes as follows:

> Here we were clear of the *Salix* and *Alnus* thickets and were on the true tundra, which afforded a welcome relief to both eyes and limbs. After the delay caused by a long and heavy snowstorm I discovered two new breeding colonies of this gull—one on the wet grassy border of a lake about a kilometer in diameter, the other in the middle of a somewhat larger lake, furnished with many tiny islands, spacious bogs, and shallow grassy areas. Both colonies contained from 10 to 12 pairs of *Rhodostethia*, accompanied by five or six pairs of terns, considerable numbers of *Limosa uropygialis*, *Phalaropus fulicarius*, *P. lobatus*, *Tringa maculata*, *Pavoncella pugnax*, *Harelda glacialis*, and a pair or two of *Scolopax gallinula*, *Colymbus arcticus*, *Squatarola helvetica*, *Charadrius fulvus*, and *Totanus fuscus*.

Mr. John H. Dalgleish (1886) reports the finding of a nest of Ross's gull by Mr. Paul Müller near Christianshaab, Greenland, on June 15, 1885. The nest "was situated in the midst of the nests of a colony of *Sterna macroura*. The female bird was shot off the nest, which, when found, contained two eggs."

Eggs.—There are four eggs of this species in the United States National Museum, which bear a decided resemblance to eggs of the Sabine's gull. They are pointed in shape and have a uniform ground color of "ecru-olive." They are rather faintly marked with irregular and indistinct spots and blotches of "Saccardo's umber." The measurements of 31 eggs, in various collections, average 43.6 by 32 millimeters; the eggs showing the four extremes measure **46.6** by 32.7, 43 by **34**, **39** by 31.5, and 44.4 by **30.3** millimeters.

Of the eggs Buturlin (1906) says:

> The rosy gull lays sometimes two, but nearly always three, eggs; four are said to be found not uncommonly, but I doubt the fact. The eggs, as might be expected from so beautiful a bird, are very handsome and, happily for the collector, are quite unlike those of the black-capped tern.
>
> The eggs of the rosy gull are not only larger and in particular broader than those of its neighbor, but are of quite a different shape, being extremely round for gulls' eggs, with the small end by no means pronounced. They are much darker and more evenly colored than any other eggs of the order known to me, being of a beautiful deep rich olive-green, without any of the grayish or

sandy shade so common in eggs of *Sterna* and other members of the order. They are spotted, especially near the larger end, with chocolate-brown (not earthy brown), the somewhat clouded spots being generally some 3–5 mm. in diameter, and not so sharply defined on the dark ground color as is usual in gavian eggs. The spots are of unequal intensity, some darker, some paler, with every intergradation; they can not be divided into two sharply defined groups as in other gavian eggs, perhaps because the dark markings do not stand out very clearly on the deep olive-green ground color.

During the daytime even the female readily leaves the nest, and flies about the pools of water or walks over the melting ice, picking up insects and often slipping in a curious way on the surface. But in the night—the sunny Arctic night—the rosy gulls which mob you at some distance from the colony are invariably males. When an intruder visits the colony the gulls fly overhead and scream, but are far less noisy and anxious than the terns. If he sits down they very soon become quiet, and the female settles down on her eggs even within 30 or 40 yards, and so betrays their position. If the nest is approached both parents hover overhead persistently, but do not venture nearer than 15 or 25 yards, the male being usually silent, but the female screaming and uttering cries of various description—now the regular note of "kiaoo, kiaoo, kiaoo; miaw, miaw, viaw, viaw; trrrrr"; now the true Larine "kwa, kwa, kwa," or even a ternlike "ee, ee, ee-kwa, iew," all with very varied intonation. When the nest has been passed some 20 or 30 paces the female settles down and looks to see if the eggs are still there. On one occasion only, after I had taken the eggs, did she pursue me angrily at close quarters, until I had left the colony; this was an intensely colored, and evidently a very old, bird.

Young.—Young rosy gulls are very lively and clever little creatures. As soon as they see an intruder they try to creep through the grass to the water, and swim away to some distance, even if the waves are comparatively heavy. More readily still they swim to the places where tufts of *Carex* and other plants, old and dry, stand up here and there in the water, and then lie on the surface, quite still, close by one of these tufts, as if conscious that their grayish-marked dirty-yellow garb corresponds so closely with the spots and strips of light and shadow playing on the dirty-yellow dead grass as to be practically invisible even at a distance of a few yards, especially if the wind, which is nearly always blowing here, is ruffling the surface. If you lie well hidden, after several minutes the little creature begins to swim about, returning to the ground or wet grass whence you disturbed it, and uttering cries as it searches for its mother. When caught it pecks your fingers, peeps and quacks, but is not much frightened.

The parents, especially the females, make a great noise around an intruder in the colony, varying their voices and notes even more than when there are eggs; "kliaw, kliaw, kliaw; kwiaoo, a-wa, a-wa, a-wa, trrrrr . . . ; pioo, kweekwoo, a-dak, a-dak, a-dak; kliaw, kliaw, eea, eea; kwa-kwa-kwa, pee-kwa, kakee-a," are heard all the time in various modulations. Near its eggs the rosy gull might appear somewhat foolish, but now all is changed. The female flies slowly just above the ground or wet grass, or partly swims, partly flutters, over the surface of the plant-covered water, settles down again, looking here and there, gently uttering her "a-wa, a-wa," and makes you feel certain that she is trying her utmost to draw attention away from her young. But if you follow her, and then suddenly stop and look back, you will often see the little one hurrying from the place where you were just searching; while in any case you will find nothing at the place where the female appeared so busy. One female insisted upon fluttering about and sitting down so long at a certain place on an island where the colony of rosy gulls and terns was situated that I carefully marked the spot and examined it, but only a tern's nest was there. I thought at first that this was only an accidental occurrence, but immediately afterwards the same female rosy gull tried to attract my attention as persistently to another spot, lying still more out of my way, and another tern's nest was there. The terns understood these treacherous tactics quite well, and at the last nest the female with angry screams engaged in a short battle with the gull.

Plumages.—The newly hatched gulls in down are some 13 or 13½ centimetres in length, but they grow quickly and measure from 18 to 20 centimetres by the time that the feathers appear on the back and flanks. Eyes dark blackish brown; legs and feet intense fleshy, tinged with gray, or fleshy gray, with brownish claws; bill grayish fleshy with brownish tip. The ground color of the downy dress is dusty yellow, varying in tinge irrespective of growth; in some examples it is pale sulphur-yellow, in others a somewhat burnt wood-yellow, occasionally, with a rusty tinge. This ground color is densely covered with numerous irregular and ill-defined blackish-gray markings, taking up at least as much space as the yellow ground color itself. They are pale and quite ill-defined on the flanks, while the middle of the breast and belly is without them and whitish. They are sharply defined and nearly black on the head, where they are narrower. The markings vary in detail in different specimens, but in all the pattern is somewhat longitudinal on the body, transverse on the nape, and wedge shaped on the crown. This pattern is much obscured, especially on the body, as the markings are so much broken up and wavy. The sides of the throat, the eyebrows, and the down which covers the uppper mandible nearly to the nostrils, are marked with dark color.

The feathers begin to appear first on the wings, and nearly at the same time on the scapulars and tail; next on the upper part of back and on the flanks, and then on the uropygium. So far as can be seen the new primaries are blackish; the secondaries and tail feathers white; the tertiaries, wing coverts, scapulars, and back feathers brownish black, with wide rusty-yellow ends, as are also upper tail coverts. Flank feathers and those of the uropygium white rusty ends and blackish-gray subapical portions.

The sequence of plumages to maturity can be only provisionally inferred from the limited amount of material available for study. Doctor Buturlin (1906) gives us a very satisfactory and detailed description of the first or juvenal plumage, the principal characters of which are: "White under parts, tinged on the chest and breast with pale grayish cinnamon buff; upper parts dark brown, barred with ochraceous on the ends of the feathers; lesser wing-coverts of the foremost and inner half of the wing white, with narrow, ochraceous tips; all the primary coverts blackish brown; the three inner primaries practically blackish brown with the inner half of the inner web (excluding the end) white; remaining primaries outwardly edged with blackish brown, decreasing inwardly; and tail white, with a narrow ochraceous tip and a blackish brown apical band."

This plumage is well illustrated in Nansen's (1899) colored plate of this species, based on specimens collected by his expedition near

Franz Josef Land, in August. The white lesser wing-coverts show very plainly in this plate, but apparently these are molted before October, as they do not show at all in Nelson's (1887) plate.

Nelson's bird, taken October 10 at St. Michael, illustrates the change into the first winter plumage, which differs from the foregoing in having the under parts pure white and having lost all traces of the white lesser wing-coverts, the ochraceous barring on the back and the ochraceous tip of the tail. Some of this may be accounted for by wear or fading, but the appearance of a few "mantle blue" feathers in the back indicates a partial molt, including, at least, the back and lesser wing-coverts.

The young bird figured in P. H. Ray's (1885) report, a bird in its first autumn, is considerably more advanced, as it has a pink breast and a blue mantle, the wings being practically the same as in Nelson's (1887) bird. This specimen illustrates the first winter plumage, which is worn with little change until spring. A partial molt, involving nearly, if not quite, all the contour feathers and the tail, takes place in the spring. This first nuptial plumage is illustrated by a bird in the author's collection, taken on the Kolyma River on June 2. In this the wings, including all the coverts, are as in the first winter plumage. The remainder of the plumage is fresh; the mantle is clear blue; the underparts are decidedly rosy; the tail is pure white; and the black neck ring is indicated by scattering black feathers. At a complete postnuptial molt, the following summer, the young bird would probably assume the adult winter plumage.

Adults apparently have a complete postnuptial molt and an incomplete prenuptial molt of the contour feathers. The black ring on the neck is characteristic of the nuptial plumage, but the pink underparts and the pure white tail are present at all seasons.

Food.—Buturlin (1906) noted the Ross's gulls chasing insects, and the stomachs which he examined contained "only fragments of coleoptera, gnats, and other insects;" therefore, on their breeding grounds, at least, their food seems to be wholly insectivorous.

Behavior.—Although he first noted the flight of this species as "more Fulmar-like," Buturlin (1906) finally concluded that it

> was really much more tern-like * * *. The rosy gull swims easily, and sometimes I saw it taking a regular bath. It dipped its head under, while sitting deep in the ice-cold lake, and, throwing the water over its back, moved its wings quickly below the surface, holding itself almost clear, and threw itself forcibly head downward into the water. Once a rosy gull flew over the surface of the lake with a cry of "carvac-wa" and took up water with its beak on the wing, as swallows do, but subsequently it settled on the surface for some two or three seconds without folding its wings, which were elevated over the back, and drank after the usual fashion.
>
> The note of *Rhodostethia* is peculiar, being high and more melodious than that of gulls in general, and very variable. The cries that I most often heard

> resembled "a-wo, a-wo, a-wo" and "claw, claw, claw" (or "cliaw, cliaw"). When disturbed the birds have a short cry of "via, via, via," and if much disappointed a longer "kiaw, kiaw" or "kiaoo, kiaoo, viaw." When quarreling they utter "miaw, miaw, miaw" and "a-dac, a-dac, a-dac," as already mentioned.
>
> The rosy gull can hardly be called a peaceful bird, though the terns, comparatively weak as they are, generally begin the trouble, for it is quite prepared to fight, if challenged. Usually the tern distances its rival in the air, but I have seen the gull catch it on the wing and give it a good shake. I once saw a female rosy gull pounce ferociously on an innocent *Calcarius lapponicus* which was passing, but she was in a very nervous state owing to my examination of her nest, which was going on.
>
> The rosy gull and its eggs are too small to be hunted up by the Lamuts or Chukchas of the delta, and rapacious birds proper are scarce there; but the eggs are often destroyed by the numerous *Stercorarii*, and I have to-day seen (June 30) two Buffon's skuas trying to catch the bird itself.

Fall.—When Doctor Buturlin (1906) visited their breeding grounds on July 22 the Ross's gulls "were nowhere to be seen; only some shells of their pretty eggs and a wing of a young bird were found near the nest of one of those greedy robbers of the tundra, *Larus vegae*." But he "observed three small gulls flying silently about with uneasy strokes of the wing, in a somewhat owl-like manner, and their silence reminded him of *Xema sabinii* during the spring migration." All of these he shot and they proved to be "young *Rhodostethia rosea*, easily identified by the form of the tail, and only one was without the remains of down on the head." These were the last rosy gulls that he saw alive; evidently they had deserted their breeding grounds and started in their fall migration as soon as the young were able to fly. They sometimes move off their breeding grounds even before the young are able to fly; for "on July 7, having disturbed a colony with the young in down, he "noticed a few hours later that the colony was deserted, and that, partly swimming, partly on foot, they had gone to the other end of the lake (or rather a chain of swampy lakes), nearly a mile distant." This exceedingly early northward migration in the half-downy stage of plumage explains why both young and old *Rhodostethia rosea* have been observed during August, or even seen after the middle of July, far away from their breeding grounds.

Nelson (1887) took a specimen of this rare gull in immature plumage near St. Michael, Alaska, on October 10, 1879. The International Point Barrow Expedition in 1881, 1882, and 1883, under Lieut. P. H. Ray, obtained a fine series of this rare bird, and I quote from Mr. John Murdoch's notes in regard to it, in Ray's (1885) report, as follows:

> In 1881, from September 28 to October 22, there were days when they were exceedingly abundant in small flocks, generally moving toward the northeast, either flying over the sea or making short excursions inshore. Not a single one

was seen during the spring migrations or in the summer, but two or three stragglers were noticed early in September—a few out among the loose pack ice; and on September 21, 1882, they were again abundant, apparently almost all young birds. They appeared in large, loose flocks, coming in from the sea and from the southwest, all apparently traveling to the northeast. Most of the flocks whirled in at the mouth of our lagoon and circled around the station with a peculiarly graceful, wavering flight, and many were shot close to the house. A cold easterly wind was blowing at the time. They continued plentiful for several days, while the east wind blew, all following the same track, moving up the shore, and making short excursions inland at each of all beach lagoons. After September 28 they disappeared until October 6, when for several days there was a large flight. On October 9, in particular, there was a continuous stream of them all day long moving up the shore a short distance from the beach, and occasionally swinging in over the land. None were seen to return.

It is difficult to form any idea of what becomes of the thousands that pass Point Barrow to the northeast in the autumn. It is certain that they do not return along the shore as they went. Nevertheless, at that season of the year they must of necessity soon seek lower latitudes. Perhaps the most plausible supposition is that soon after leaving Point Barrow, perhaps when they first encounter the main ice pack, they turn and retrace their steps so far out at sea as to be unnoticed from the land, and pass the winter at the edge of the ice field, proceeding north to their breeding ground, as the pack travels north in the spring. Capt. Everett Smith, of the steam whaler *Bowhead*, who is a trustworthy witness, reports that when he was in the loose ice, 70 miles northwest of Point Hope, on June 10, 1883, he saw large numbers of these birds.

Nansen's (1899) discovery of Ross's gulls in large numbers near Franz Josef Land in August, would seem to indicate that there are other breeding grounds farther west along the Siberian coast, or that there is a westward as well as an eastward migration after the breeding season. After August 23, when the channels and lanes about the ship froze up, these gulls disappeared. What becomes of these birds in winter, when it is impossible for them to obtain food in the Arctic Ocean, is a question which still remains to be answered. A specimen is recorded by Dr. B. W. Evermann (1913) as taken on St. George Island, Pribilof Islands, on May 25, 1911, which suggests the possibility that Ross's gull may winter in the open waters of the North Pacific Ocean; but, if so, it is strange that no specimens have been recorded from that region.

I would refer the reader also to Mr. Murdoch's (1899) excellent historical account of this species, telling us practically all that was known about it at that time.

DISTRIBUTION.

Breeding range.—Probably circumpolar, but erratic and irregular. Known to have bred on the Arctic coast of northeastern Siberia (Kolyma Delta) and on the Indigirka River from its mouth to 300 miles inland. Said to have bred once in western Greenland (Disco

Bay), but the record is open to some doubt. Taken in summer, and perhaps was breeding near Spitzbergen (82° N.), Franz Josef Land (Hvidtenland) near the Bennett Islands, near Wrangel Island, in northeastern Siberia (Pitlekaj), and on Melville Peninsula (Alagnak).

Winter range.—Unknown. Taken at Bering Island, December 10; Heligoland, February 5; Faroe Islands, February 1; France (coast of Verdée), December 22; and Italy (Sardinian Sea), January.

Spring migration.—Taken in the Pribilof Islands (St. George), May 25, probably a straggler.

Fall migration.—Birds leave their breeding grounds in northeastern Siberia about July 20 and are abundant at Point Barrow, flying east, between September 10 and October 9. Taken at St. Michael, Alaska, October 10; at Heligoland, October 25 to November 10; and at New Siberia Islands in September.

Casual records.—Accidental in England (Yorkshire), in France (Verdée, December 22, 1913), and in Italy (Cagliari Bay, January, 1906).

Egg dates.—Kolyma Delta: Three records, June 9, 10, and 11.

XEMA SABINI (J. Sabine).

SABINE'S GULL.

HABITS.

This beautiful little gull was named for its discoverer, Capt. Edward Sabine, who first saw it on its breeding grounds on some low rocky islands off the west coast of Greenland, where it was associated and breeding with a number of Arctic terns. It is not an abundant bird, however, on the Greenland coast, but it has been found breeding at widely scattered points in the Arctic regions of both hemispheres. Its center of abundance during the breeding season seems to be in the vicinity of Bering Sea. Dr. E. W. Nelson (1887) says:

> All the marshy coast districts on both shores of Bering Sea are chosen resorts for this beautiful gull during the breeding season. It is especially numerous along the Alaskan coast from the Kuskoquim mouth to Kotzebue Sound and on the Siberian side from Plover Bay to beyond the Straits, but they occur more as birds of passage along the latter coast than as summer residents.

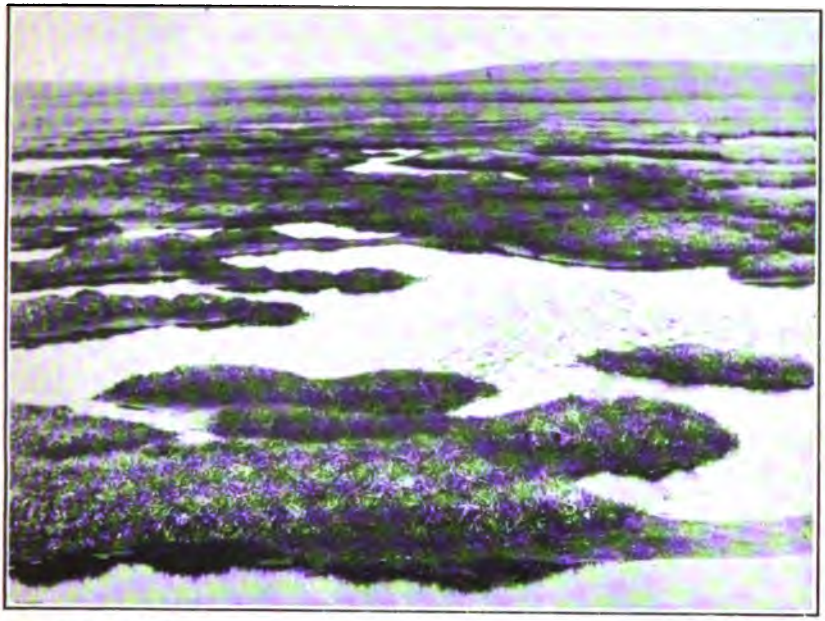
In the vicinity of St. Michael he

> found these birds to be among the most numerous of the gulls, and the main body of arrivals came in the spring, as the ponds and small tide creeks were nearly free from snow and ice, dating from the 15th to 25th of May. At this season they wander in company with the Arctic tern, but the last of May or 1st of June they congregate about the parts of the marshes selected for their nesting ground.

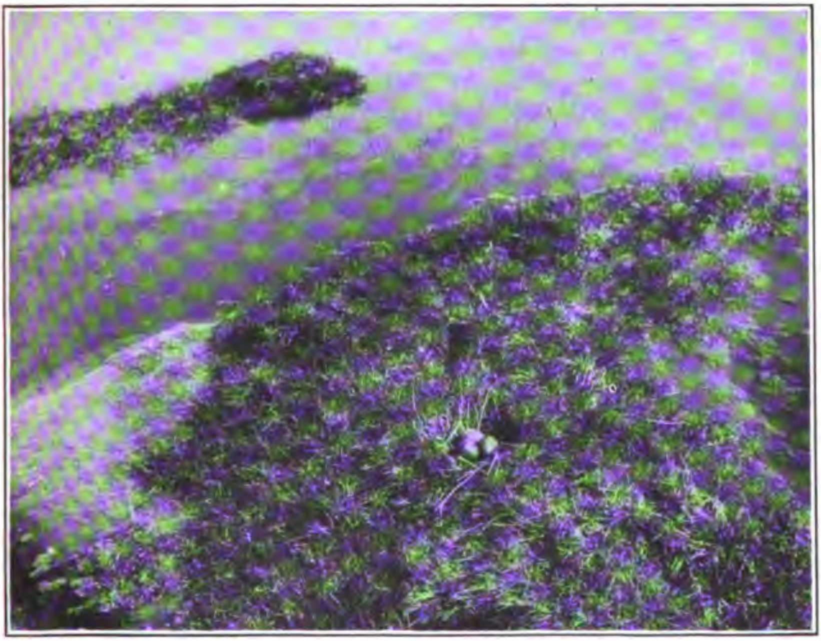
Nesting.—The same author gives the following interesting account of his experience with a nesting colony:

> On June 13, 1880, about 20 miles from St. Michael, while egging in company with some Eskimo, we found a pond, some 200 yards across, in the middle of which were two small islands. A gunshot caused at least 100 of these gulls to rise like a white cloud over the islet, and showed us that we had found a breeding place. As we stood on the shore a few birds came off, and circling close about us for a few moments, but rarely making any outcry, returned to the island, where the others had already settled again and appeared to be sitting upon the ground. The water of the lake we found to be about waist-deep, under which lay a solid bed of ice of unknown depth.
>
> The smallest island lay nearest, and sending one of my men out to it he found a set of two eggs of the black-throated loon, one set of the arctic tern's eggs, and two of Sabine's gull. Proceeding to the next island he found a set of *Aythya marila nearctica* eggs as he stepped ashore, and a moment later cried out that the ground was covered with gulls' eggs. At the same time he answered with chattering teeth that the water in the lake was very cold. Having never seen the nest of this gull I called my man back and he transported me upon his back to the island after narrowly escaping several falls on the way. The island was very low, and the driest spots were but little above the water. Built on the driest places were 27 nests, containing from one to three eggs each, and as many others just ready for occupancy. Four or five nests were frequently placed within two or three feet of each other. In about one-half the cases the eggs were laid upon a few grass blades the spot afforded with no alteration save a slight depression made by the bird's body. In the majority of the other nests a few grass blades and stems had been arranged circularly about the eggs, and in the remainder only enough material had been added to afford the merest apology for a nest.
>
> While I was securing my prizes the birds hovered overhead in great anxiety, although they rarely uttered their grating cry, and in the very few instances when a bird darted down at us it was in perfect silence. While we were on the island several glaucous gulls and jaegers passed by, and in every case they were attacked by several of the Xemas and driven hastily away. Two nests had been despoiled either by these birds or a muskrat, as the broken shells showed. When the eggs were secured a large and fine lot of gulls were obtained, and we then made our way back to camp heavily laden with spoils. Solitary nests were afterwards found either on islands like the last or on the border of a pond. In one instance the female left her eggs when I was over 100 yards away and flew directly away until she was lost to sight.

Thirty-five years later Mr. Hersey visited the same locality to gather information for this work. On June 19, 1915, he found a colony of about six nests that had been completely washed out by a recent heavy storm accompanied by unusually high tides. The nests were all mere hollows in the wet ground with hardly any lining. Broken eggshells were lying all about and a few dead young were seen. In other places he found other similar nests containing broken eggs—about 15 in all. This disaster evidently discouraged the gulls, for, although he visited the locality later, they apparently did not attempt to lay again. A typical nest of this species containing three eggs was found on June 5, 1915; his notes describe it as located on a



St. Michael, Alaska. F. S. Hersey.



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narrow tongue of land projecting into a small pond among a network of ponds on the tundra. The nest was a slight hollow in the wet ground, 5 inches in diameter and 2 inches deep, lined with a few dry grass stalks. The nest cavity was wet and the eggs were covered with a coating of mud. Both of the parent birds showed anxiety while he was some distance from the nest, but kept quiet when he was near it. After he had taken the eggs the birds followed him for half a mile, darting about his head.

The Canadian Neptune Expedition to Hudson Bay, according to Rev. C. W. G. Eifrig (1905), found the Sabine's gull "common on Southampton and other islands, breeding there along the shores and the banks of small ponds, in company with the Arctic tern. They make no nest but deposit their eggs in the sand. Two eggs were taken at Southampton, June 28, 1904."

Eggs.—Three eggs, or often only two, constitute a full set. They are ovate or pointed ovate in shape. The ground color is "Dresden brown," "Isabella color," "ecru olive," or "deep olive-buff." They are seldom conspicuously marked, but are usually faintly and irregularly spotted and blotched with "Saccardo's umber" or "sepia." Sometimes they are more clearly and boldly marked with "sepia," "bister," or "warm sepia;" occasionally an egg is marked with a few bold markings of "blackish brown;" and sometimes the markings are concentrated in a ring around the larger end. The measurements of 56 eggs, in the United States National Museum, average 45.5 by 32 millimeters; the eggs showing the four extremes measure 49.5 by 31.5, 47 by 34, and 39.5 by 30 millimeters.

Young.—Nothing seems to be known about the period of incubation, but both birds apparently incubate and are very devoted in the care of the young. Mr. Hersey noted that when the birds were hiding in his vicinity the parents frequently alighted on the ground near him and ran back and forth with trailing wings after the manner of shore birds, but unlike other gulls or terns.

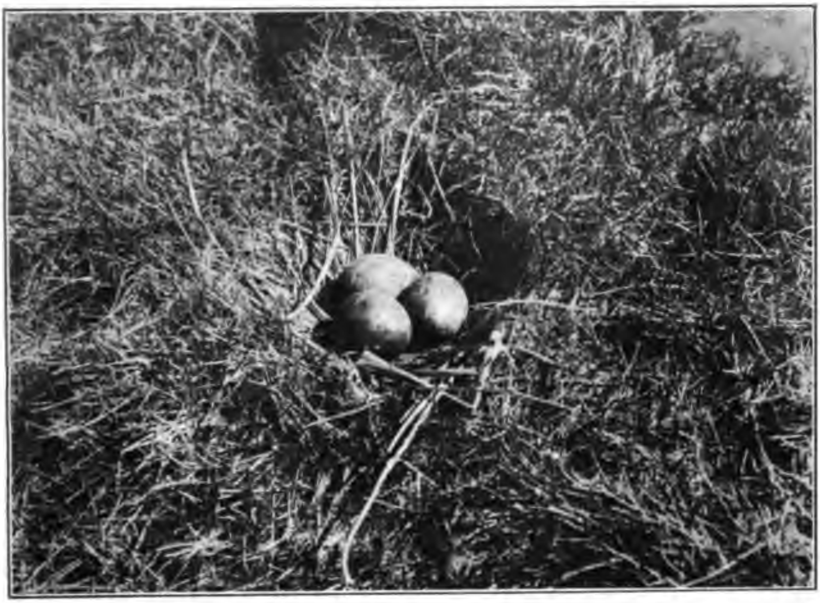
> The young are less active than most young gulls; at the approach of danger they either sit perfectly still with half-closed eyes or march slowly away in the dignified manner of adult gulls. They have a note like the adults, but it is not so sharp and is lacking in strength. While in the downy stage they hide in the grass, but when about two weeks old and nearly fledged they begin to frequent the small ponds when they swim about; if danger threatens they swim ashore and hide. Even at this age the old birds watch them constantly, and any glaucous or short-billed gull that comes near is promptly driven away, several Sabine's gulls uniting in the pursuit to protect the helpless young.

Plumages.—The downy young is dark colored, from "ochraceous tawny" to "tawny olive" on the upper parts and throat, paler on the chin, fading off to "pale pinkish buff" or paler on the belly. The crown and sides of the head are distinctly spotted or streaked with black and the rest of the upper parts are thickly but indistinctly mottled with "fuscous black"; the under parts are immaculate. The young bird grows rapidly and the juvenal plumage soon appears; the down is retained on the tips of the feathers until the bird is nearly fully grown, wearing away or dropping off gradually, until the last of it finally disappears from the head, neck, flanks, and rump. In this plumage the crown and the sides of the head and neck are clouded or washed with different shades of "mouse gray"; the throat and under parts are pure white, and the upper parts are mainly dusky or "fuscous." The feathers on the anterior gray portions are narrowly edged with pale buff; these edgings increase in breadth, extent, and intensity of color on the back, wing-coverts, and scapulars, becoming "clay color" or "tawny olive" on the latter feathers. The wings and tail are as described in the next plumage. The first winter plumage is but a continuation of the juvenal; the buffy edgings described above fade out or wear away during August and September, leaving the plumage of the upper parts more uniform "fuscous" or pale grayish brown. The primaries are dull black without the conspicuous white tips of the adult wing, but the secondaries are white, producing the large white wing patch so characteristic of the species. The tail is white, broadly tipped with black, especially on the central rectrices; the bill is wholly dusky. A partial prenuptial molt takes place in the spring, at which the gray hood and black collar of the nuptial plumage are partially assumed, the amount of white remaining on the throat and head varying greatly in different individuals. At the next complete molt, the first postnuptial, in August and September, the adult winter plumage is assumed, and young birds become indistinguishable from adults.

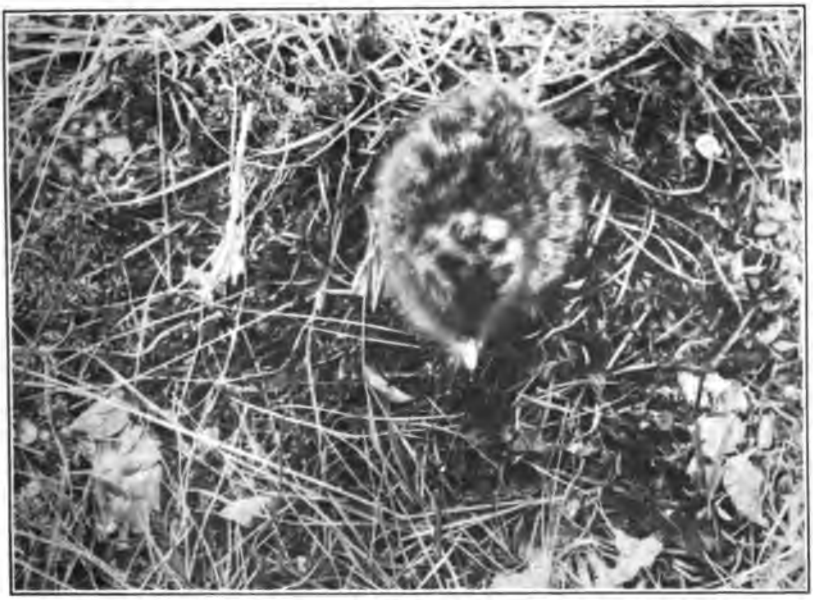
Adults have a partial prenuptial molt, at which the gray hood and black collar are acquired before May, and a complete postnuptial molt in August and September. The latter is very variable in time and often very late; it is often completed in August and sometimes does not begin until nearly the middle of September; the black collar is the last to go. The winter plumage is similar to the spring dress except that the head is white, heavily clouded with dusky on the occiput, and hind neck; the bill becomes black.

Food.—On their breeding grounds, the Sabine's gulls feed in the small ponds and pools on the tundra, where they find small fishes, aquatic worms, insects, and larvae, and small crustaceans. They hover over the pools, daintily picking up their food from the surface, but apparently never diving for it. Mr. Hersey says in his notes:

> These gulls spend much time, when the tide is out, feeding about the mud flats, where they run about like shore birds; so much do they resemble them



St, Michael, Alaska. F. S. Hersey.



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that I have repeatedly mistaken them for plover when the light was poor and I could not easily make out their markings. The young, with their white breasts and dark backs, even more closely resemble birds of this family.

Behavior.—On the wing this species bears a closer resemblance to a tern than it does to the other gulls. It flies with continuous wing beats, seldom, so far as I have observed, sailing, and its flight is direct though not straight. It may swoop to the earth to pick up a bit of food or hover a moment if something attracts its attention, but only for an instant does it delay before resuming its onward flight in the direction it was going. It seems almost devoid of curiosity. I have never had one fly about me when walking over the tundra, as the short-billed gulls and Arctic terns frequently do, and unless I am directly in its path I have never seen one turn aside in its flight to look at me. If one of their own species or another bird is shot they pay no attention to the fallen comrade, even if it be only wounded. They attend strictly to their own business. They usually fly singly or with one or more short-billed gulls, but sometimes two are seen together, rarely three. Except on their breeding grounds they are not social and are generally silent. At St. Michael I have seen as many as six birds together on the bay, but on land they are usually solitary. When a number do come together on the water it appears to be the presence of food that attracts them rather than a desire for the society of their own or other species. When a half dozen birds are resting on the water it is usual to see them scattered about, each 80 or 100 yards from his nearest neighbor and not close together, as other gulls generally are.

Doctor Nelson (1887) says of the notes of this species:

> Sabine's gull has a single harsh, grating, but not loud note, very similar to the grating cry of the Arctic tern, but somewhat harsher and shorter. When wounded and pursued or captured it utters the same note in a much higher and louder key, with such a grating file-like intensity that one feels like stopping his ears. It has the same peculiar clicking interruptions which are so characteristic of the cry of a small bat held in the hand. A low, chattering modification of this is heard at times as the birds gather about the border of a favorite pool, or float gracefully in company over the surface of some grassy bordered pond. The same note, in a higher key, serves as a note of alarm and curiosity as they circle overhead or fly off when disturbed. When one of these gulls is brought down the others of its kind hover over it, but show less devotion than is usually exhibited by the terns.

Fall.—Nelson (1887) says further:

> As August draws to a close, young and old forsake the marshes to a great extent, and the rest of the season are found scattered along the coast feeding at the water line on the beeches. Toward the end of September they become more and more scarce until only a comparatively small number are found at the beginning of October; but the last ones remain until the 8th or 10th of this month, and these birds are usually the young of the year.

Winter.—On the southward migration the Sabine's gull has occurred on both coasts of North America, probably migrants from different breeding stations, and at many points in the interior. Prof. W. W. Cooke (1915) says that "the only place where Sabine's gull has been found in winter is on the coast of Peru. Here it is common in Callao Bay from December to April." He also suggests that "whenever the winter home of Ross's gull is discovered, Sabine's gull will probably be found there also, for the two species arrived together at the mouth of the Kolyma River, Siberia, the 1st of June, 1905, and were together when seen in migration in May several hundred miles west of that district."

DISTRIBUTION.

Breeding range.—Arctic coasts of both hemispheres. In the Western Hemisphere, east to northeastern Greenland (Cape Bismarck). South to central western Greenland (Upernavik), northern Hudson Bay (Southampton Island), Boothia Peninsula, Victoria Land (Cambridge Bay), northern Mackenzie (Franklin and Liverpool Bays), northern Alaska (Point Barrow and from Norton Sound to Hooper Bay), and St. Lawrence Island, Bering Sea. In the Eastern Hemisphere it is known to breed in northeastern Siberia (near Bering Strait), in northwestern Siberia (Taimyr Peninsula) and on Spitzbergen. The northernmost breeding record is at Thank God Harbor, northern Greenland, 81° 40′ North.

Winter range.—The only known winter range seems to be on the coast of Peru from Tumbez to Callao Bay.

Spring migration.—Northward along both coasts and in the interior of North America. Dates of arrival: Maine, Scarborough, May 31; Cumberland Gulf, June 15; Melville Peninsula, Winter Island, June 29; Ellesmere Land, Fort Conger, July 6; Illinois, Chicago, April 1; Manitoba, Norway House, June 11; California, Monterey, April 9 to May 21; British Columbia, Bell Bella, May 24; Yukon, Chilkat Inlet, June 1; Alaska, St. Michael, May 7 to 25, Point Barrow, June 2 to 6, and Demarcation Point, May 28. Some birds remain in Peru until April.

Fall migration.—Southward by same routes. Dates of arrival: Maine, Portland, September 22; Massachusetts, August 21 to September 27; New York, Long Island, October 7; Iowa, Burlington, October 12 to 15; Nebraska, September 2 to 30; Washington, Shoalwater Bay, September 24; California, Monterey, July 22. Dates of departure: Melville Peninsula, Igloolik, August 13; Greenland, Kikkerton Island, October 6; Alaska, Point Barrow, September 17 to October 22; California, Monterey, October 28.

Casual records.—Accidental in Bermuda, Switzerland, and Austria-Hungary. Occasional in winter in British Islands and northern France.

Egg dates.—Northern Alaska: Eight records, May 28 to July 6; four records, June 8 to 28. Northern Mackenzie: Seven records, June 20 to July 10; four records, July 5 to 7.

GELOCHELIDON NILOTICA (Linnaeus).

GULL-BILLED TERN.

HABITS.

This species was referred to by the earlier writers as the marsh tern, on account of its preference for the salt marshes as a feeding ground, and in many places as a breeding ground also; but, based on my limited experience with it on the Atlantic coast, I should say that it hardly deserves that name, for, at the present time, on the coasts of Virginia and the Carolinas, it seems to prefer to nest on the sandy beaches. But, as it is a cosmopolitan species of wide distribution, its habits differ in different localities. It was formerly much more abundant and more widely distributed on our Atlantic coast than it is to-day, where it is now one of the rarest of the terns. The reduction in its numbers and the restriction of its breeding range may have resulted, by natural selection, in the survival of those individuals which chose to breed on the beaches, where their eggs were not so easily found, and the annihilation of those which nested in the marshes. In support of this theory Mr. H. H. Bailey (1913) says of its breeding habits on the Virginia coast:

> The nest location of the few remaining pair has changed from the inner side of the island sand dunes and marsh edges to the open beach, but now well concealed amongst the oyster shells, rocks, and pebbles, not an unsimilar location from that of the oystercatcher.

Doctor Stone (1908) regards it as "a rare straggler" on the New Jersey coast to-day. He says:

> Formerly it bred rather commonly on the marshes of Cape May County, where it was discovered by Wilson about 1818. In 1869 Turnbull regarded it as rare. In 1886 Mr. H. G. Parker reported it still nesting at the lower end of Seven Mile Beach, and Mr. C. S. Shick spoke of it as still present in 1890, associating with the laughing gulls. We have no subsequent record for the State.

On the Virginia coast Doctor Rives (1890) referred to it as "common at Cobb's Island, and breeds, formerly in great abundance," indicating that, even at that date, it had begun to decrease. He says further:

> I have been informed that great numbers of the eggs have formerly been taken from the north end of Hog Island, adjoining Cobb's.

Ten years later, in 1900, Captain Andrews reported to Mr. Dutcher (1901) that the gull-billed terns on Cobb's Island had been reduced to about a thousand. The following year, according to the same authority, their number had been reduced to 300. In 1903, Doctor Chapman (1903) found only eight pairs there; and when Doctor Bishop and I visited Virginia in 1907 we saw only two pairs on Cobb's Island, and perhaps 8 or 10 pairs on Wreck Island, a few miles distant. Mr. A. B. Howell (1911) visited Cobb's Island in 1909 and recorded eight pairs. This record shows clearly the results of the same causes which annihilated the least terns in this region—the demands of the millinery trade for the decoration of women's hats and the zeal with which a lucrative trade was pushed by local gunners. Apparently the few survivors are holding their ground and perhaps increasing under adequate protection.

Spring.—From its winter quarters in Central and South America the gull-billed tern makes it spring migration along the coast in March and April. Audubon (1840) gives the following account of it:

> The marsh tern is pretty abundant about the salt marshes of the mouths of the Mississippi in the beginning of April; and by following the shores of the Gulf of Mexico you will find that it comes to us from beyond Texas, as many make their appearance along that coast in a straggling manner during spring, there being seldom more than half a dozen together, and generally only two. Their journeys are performed over the waters of the sea, a few hundred yards from the shore; and when in want of food they diverge from their ordinary course, and ranging over the land satisfy their hunger, when they resume their route.

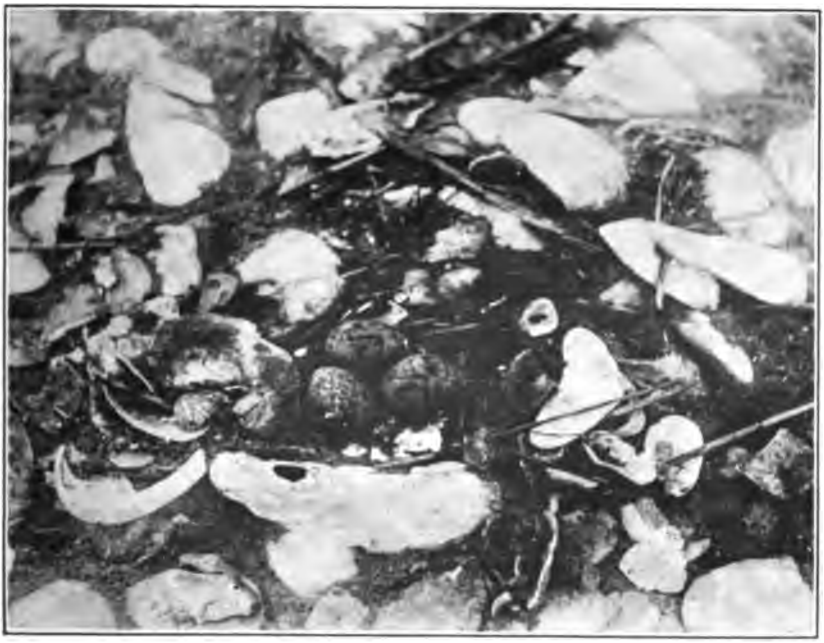
Wayne (1910) says that it arrives in South Carolina "about the middle of April and is sometimes common up to May 10, but does not breed. It does not frequent the salt marshes while on this coast, but prefers the sandy beaches."

Courtship.—Audubon (1840) has given us the only account of what might be considered a nuptial flight. He says:

> Excepting the Cayenne tern, I know no American species that has so powerful a flight as the present. To this power is added an elegant lightness that renders it most conspicuous and pleasing during the love season. Then "the happy pair" are seen to rise in elegant circling sweeps, almost in the manner of hawks, and only a few feet apart, until they attain a height of about 200 yards, when they come close together, and then glide with extended pinions through the air, the male over the female, both emitting tender and plaintive notes, while they vary their evolutions at the same height for five or six minutes. After this the winged lovers separate, plunge toward the earth with wonderful rapidity, resume their ordinary notes, and seek for food in concert.

Nesting.—On Cobb's Island and Wreck Island, Virginia, we found four nests on June 26 and 28, 1907. These were all placed on the high, dry sand flats, back of the beaches, beyond the reach of the ordinary tides, but where the spring tides had deposited large quantities of oyster, clam, and scallop shells, with numerous small stones scattered over the sand. These were excellent places for the concealment of the eggs, which so closely resembled small spotted stones that it was very difficult to find them. The nests were quite characteristic and entirely different from other terns' nests; three of them were merely slight hollows in the sand, among the clam and oyster

Cobb Island, Virginia. A. C. Bent.



Cobb Island, Virginia. A. C. Bent.

GULL-BILLED TERN.

FOR DESCRIPTION SEE PAGE 333.

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shells, lined with a few small pieces of shells and bits of straw. The other was a very elaborate structure—a large pile of dead sedge stems, gathered from a neighboring marsh, and the shells of oysters, clams, and scallops. It was lined with small clam and oyster shells, making quite a pretty picture. I measured this nest and found it to be about 18 inches in diameter externally and 4 inches internally. All of these nests were in or near breeding colonies of black skimmers, among which a few pairs of common terns were also nesting.

Dr. Paul Bartsch writes to me as follows regarding a breeding colony of this species that he found in the Bahama Islands:

> On May 28, 1912, we visited Little Golden Key, which is listed as Middle High Key on the Andros Island chart. The northwest corner of this island consists of a sand spit, the edge of which has been worn off by strong tidal currents. Here we found a large flock of gull-billed and least terns. I crawled up to the edge of the sand bar from the rear and found myself face to face with them, almost too close to them to take a picture, but succeeded in capturing several snapshots, one of which I send to you herewith. On the northeast side of this same island we found the gull-billed terns breeding. I should say that the colony probably embraced 25 pairs. It seemed rather remarkable to find gull-billed terns assembled in a colony, for my experience heretofore had been to find them nesting scattered among colonies of the common tern; at least this has been the case wherever I have observed them breeding on our Atlantic coast.

I have no recent information about its nesting habits in Texas, but Davie (1889) says:

> Dr. James C. Merrill and George B. Sennett found a colony of this species, in company with *Sterna forsteri*, breeding on a grassy island among lagoons and marshes near Fort Brown, Tex., May 16, 1877. The nests were slight depressions among the short grass, and the eggs were frequently wet.

It also breeds on the sandy islands on the coast of Texas, depositing its eggs in slight hollows in the sand.

Eggs.—The gull-billed tern raises but one brood in a season and lays ordinarily two or three eggs; sets of four eggs are occasionally laid, but they are uncommon. The eggs are characteristic and are easily recognized by their size and shape. In general appearance they are rounder and lighter colored than the eggs of any of the medium-sized terns. In shape they are usually ovate or short ovate, well rounded at the small end. The ground color varies from "warm buff" or "pinkish buff" in the darkest eggs to "cartridge buff" or "ivory yellow" in the lightest eggs; the prevailing colors are the lighter shades of buff. The markings consist of spots and blotches of various sizes and shapes scattered irregularly over the egg in varying amounts, but a majority of the eggs are not very heavily marked. The underlying spots show all five shades of "brownish drab," and the heavier markings are in various shades of the darker browns, such as "Vandyke brown," "bister," and "sepia." The measurements of 47 eggs in the United States National Museum average 47 by 34 millimeters; the eggs showing the four extremes measure 51 by 35.5, 49 by 36, 44 by 33.5, and 46 by 32.5 millimeters.

Plumages.—The downy young is "pinkish buff" or "cream buff" on the upper parts, shading off to white on the breast and belly; sometimes it is almost unspotted, but usually it is more or less mottled, streaked or spotted with black on the back and on the head. The juvenal plumage is acquired first on the wings, then on the scapulars, back and breast. This plumage is largely "pale gull gray" on the back, with a decided brownish suffusion, which is due to broad edgings of "snuff brown" and "clay color," deepest on the back and most extensive on the scapulars. These browns gradually fade out, before the bird is fully grown, to produce a soft mottled effect on the upper parts, pale buffy tints on a pale gray ground color. The partial postjuvenal molt begins early in September, and the change into the first winter plumage is rapid. The mottled or dusky marked feathers of the upper parts are replaced by the "pale gull gray" feathers of the adult and the heads become whiter. The young bird in its first winter plumage is much like the winter adult, but can be recognized by its slightly smaller bill and by having more dusky streaks on the crown and cervix, as well as traces of dusky in the tail. I have not been able to trace the first prenuptial molt, but infer that it is complete, and that it probably produces a plumage indistinguishable from the adult. I have not been able to find any spring birds showing any signs of immaturity.

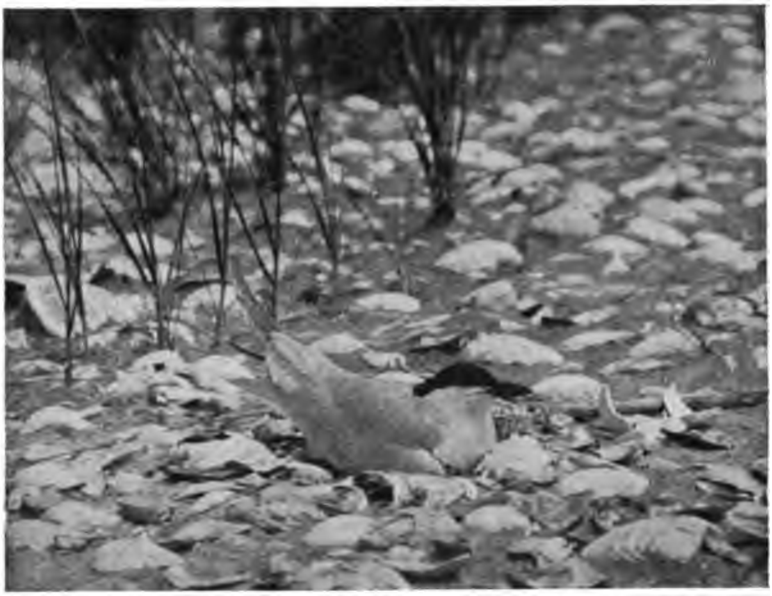
Adults probably have two complete molts each year, as in the other terns. They are in full nuptial plumage when they arrive in March; the postnuptial molt occurs in August and September. The adult winter plumage is like the nuptial, except that the head is wholly white, with more or less slaty-gray in the orbital and auricular regions.

Food.—All observers seem to agree that the gull-billed tern is mainly, if not wholly, insectivorous in its feeding habits. Wilson (1832) says:

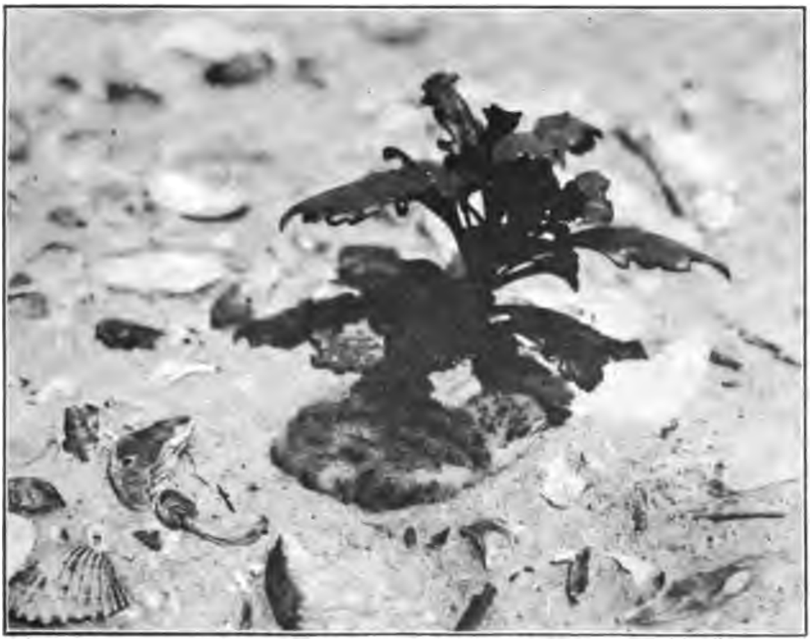
> This new species I first met on the shores of Cape May, particularly over the salt marshes, and darting down after a kind of large black spider, plenty in such places. This spider can travel under water, as well as above, and during summer at least, seems to constitute the principal food of the present tern. In several which I opened the stomach was crammed with a mass of these spiders alone. These they frequently pick up from the pools as well as from the grass, dashing down on them in the manner of their tribe.

Audubon's (1840) spirited drawing illustrates this species in pursuit of an insect. He says:

> I believe that these birds never immerse themselves in the water, as other terns are wont to do; nor do I think that they procure fish, as, on examining a number of individuals, I never found any other food in their stomachs than insects of various kinds.



Cobb Island, Virginia. F. M. Chapman.



Cobb Island, Virginia. H. K. Job.

GULL-BILLED TERN.

FOR DESCRIPTION SEE PAGE 333.

Gätke (1895) notes similar habits for the species in Heligoland, in the following words:

> Anyone who, day after day, has watched the terns darting down into the sea from great heights, so that the foam spurts high into the air must feel particularly surprised to see a bird so similar in appearance roving about over the fields, suddenly dropping among the long stalks of the potatoes and disappearing from sight. Such, however, is the only way in which the bird seeks its food on this island; for it has never been seen fishing on the sea like the other members of the genus.

Yarrell (1871) credits it with eating other food to some extent, as follows:

> The food of this species is somewhat varied. In Ceylon Col. W. V. Legge found it to consist of frogs, crabs, and fish; in Egypt, Von Heuglin observed the bird darting into the dense smoke of a prairie fire in pursuit of locusts; and in Algeria Mr. Salvin noticed it hovering over grass fields and pouncing upon grasshoppers and beetles. It also captures many species of insects on the wing.

Behavior.—The flight of the gull-billed tern is slightly heavier and steadier than that of the other small terns, but it is strong and at times very swift; it seems to have better command of itself on the wing. When traveling it usually flies at a considerable height with rapid wing beats and with steady and direct purpose. When in pursuit of its insect prey its plunges are exceedingly swift and daring. It shows also much of the skill of a swallow in making quick turns or in darting about with great velocity. It shows its command of its movements in its sudden plunges to the ground or to the surface of the water, where it secures its food, as it checks its descent, and darts away again, all of which is done with the grace and ease of an expert. I believe that it never dives and seldom swims, though, of course, it can do both.

I know of no very distinctive field mark by which the gull-billed tern may be easily recognized, although its flight is characteristic, its tail is shorter and less deeply forked than that of the common tern, and, if near enough, its heavy black bill will identify it.

The hoarse voice of this species and its characteristic notes will serve to identify it with certainty. On its breeding grounds its notes sounded to me like "Katydid, Katydid," or "Kadid," accented on the last syllable, or sometimes like "Killy" or "Killy-Kadid," all quickly uttered, loud, and rasping. Mr. Montague Chamberlain (1891) describes the notes "by the syllables *Kay-wek*, *Kay-wek*." Yarrell (1871) says:

> During the breeding season its note resembles the syllables *che-ah*, and, at other times it utters a laughing *af*, *af*, *af*, like a gull.

Its behavior with relation to other species seems to be above reproach. It associates freely on its breeding grounds with common terns, Forster's terns, laughing gulls, and black skimmers. Reports that it destroys the eggs of other birds seem to have no foundation in fact. Audubon (1840) says that he has seen "this species mastered and driven from its feeding grounds by the kingbirds and the martins," which would seem to indicate that it is a gentle bird and far from quarrelsome.

Winter.—The winter home of the gull-billed tern is far beyond our borders in southern Mexico and South America. Very little seems to be known, or to have been published, regarding its winter habits.

DISTRIBUTION.

Breeding range.—The American form breeds on the Atlantic and Gulf coasts, formerly from New Jersey, now from Virginia (Northampton County) southward to southern Texas (Nueces and Cameron Counties) and Mexico (Tamaulipas). On the Bahama Islands (Andros, Eleuthera, Inagua, Long Island, etc.) and Cuba. Closely allied forms breed in other parts of the world, making the species cosmopolitan.

Winter range.—Mainly in South America, southern Brazil, Argentina, Patagonia, and Chile. A few winter as far north as Guatemala (Chiapam), Mexico (Tehuantepec) and even Texas and Louisiana.

Spring migration.—Early dates of arrival: Bahama Islands, May 5; Bermuda, April 29; Virginia, Cobb's Island, May 10.

Fall migration.—Southward along both coasts of South America, arriving in Argentina, September 18, and Ecuador in September. Recorded at Barbados, October 7.

Casual records.—Stragglers have been taken at various points along the coast as far east as New Brunswick (Grand Manan, August, 1879).

Egg dates.—Virginia: Forty records, June 2 to July 8; twenty records, June 12 to 26. Texas: Nineteen records, May 3 to June 10; ten records, May 6 to 28.

STERNA CASPIA Pallas.

CASPIAN TERN.

HABITS.

Among the vast hordes of sea birds nesting in the great colonies of the southern Atlantic and Gulf coasts, this king of all the terns may be seen climbing into the air on its long, strong wings, its big red bill wide open, yelling out its loud raucous cry of defiance. As the dominant, ruling spirit in the colonies it scorns the companionship of humbler fowl, holds itself aloof, and lives a little apart from the others. The largest, the strongest and the fiercest of the terns, it well deserves the name, imperial tern. It was christened Caspian tern by Pallas, because it was first described from a specimen taken near the Caspian Sea. It is a cosmopolitan species of wide palaearctic and nearctic distribution.

Spring.—Although resident throughout the year on our southern coasts, it is a summer visitor only to all of its northern breeding grounds. On the New England coast it occurs as a migrant to and from its summer home in Labrador. Mr. William Brewster (1879) evidently found it quite common here at one time, for he says:

> During the first week of May, 1875, I found them quite numerous at Chatham, Massachusetts. They frequented the sand bars near the shore, and kept apart from the herring and black-backed gulls, the only other species of Laridae present at the time.

I have always considered the species rare here during recent years, and it is by no means abundant in Labrador. Of its spring migration in Minnesota Dr. P. L. Hatch (1892) says: "Usually, about the 1st of May, or possibly a little earlier, the Caspian tern makes its appearance, and for only a short time is seen passing rapidly from lake to lake in search of its favorite food, the fresh-water mussels, with which the margins of the marshland streams and lakes abound. The flight is a marvel of gracefulness, ease, and unwearied maintenance, never failing to arrest the attention of anyone at all interested in the birds."

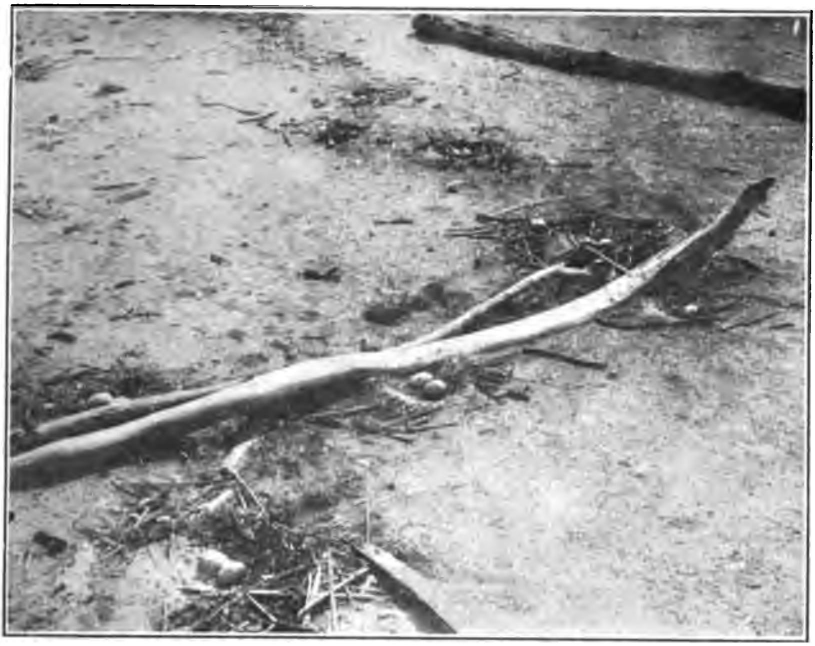
Nesting.—The breeding range of the Caspian tern in North America includes a number of widely scattered localities, in which it nests under widely different conditions.

Audubon (1840) was the first to record the breeding of this species on the south coast of Labrador. He evidently did not recognize the difference between this and the royal tern, for he referred to both under the name, Cayenne tern. On June 18, 1833, he "found it sitting on two eggs deposited in a nest neatly formed of moss and placed on the rocks, and this on a small island, in a bay more than 12 miles from our harbor, which itself was at some distance from the open gulf. On another sequestered islet some were found amidst a number of nests of our common gull" (ring-billed gull). We saw only a single Caspian tern on the south coast of Labrador, near Natashquan, in 1909; but Mr. M. Abbott Frazar (1887) found a colony "about 20 miles to the westward of Cape Whittle," consisting "of some 200 pair, mixed with a larger settlement of ring-billed and a few herring gulls. Their nests were built upon the ground, and generally contained two eggs, never more."

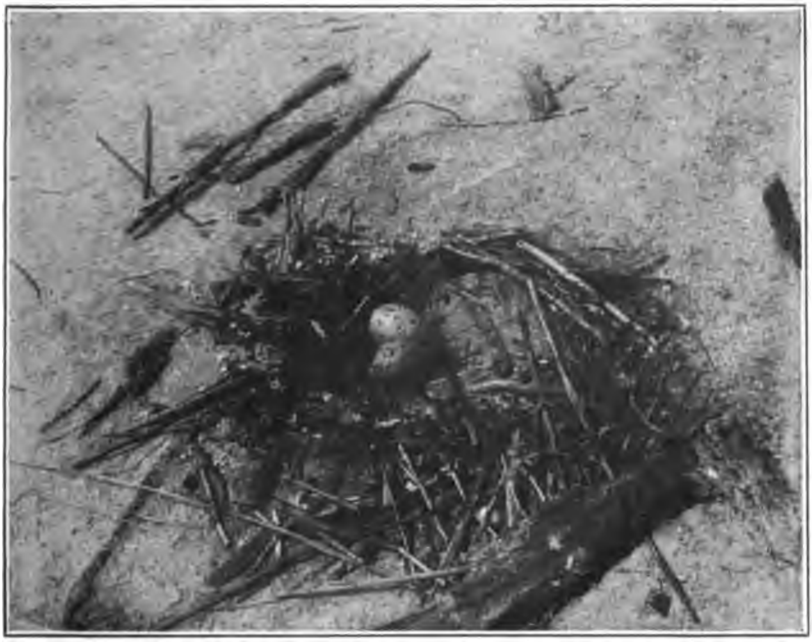
On the Virginia coast, according to Mr. H. H. Bailey (1913), "a few pairs still breed on one of our coastal islands." The Caspian tern was never abundant there, but one or two pairs have several times been found breeding there, laying two eggs in a hollow scooped in the sand. We did not see any Caspian terns in our visit to these islands in 1907.

My only experience with the nesting habits of this fine species was in 1910, in the Breton Island reservation, off the coast of Louisiana. Here, on June 18, on Grand Cochere Island, a low, flat, sandy island, a hundred miles offshore, we found about 40 pairs of Caspian terns breeding. The island is more fully described under the royal tern, which was breeding here in immense numbers. The Caspian terns did not mingle with the large colonies of royal and Cabot's terns, but had selected the extreme eastern end of the island entirely apart from the others, where they had placed their nests in a fairly compact colony among the scattered rows of driftwood and rubbish, which offered some slight concealment. The nests were large, deep hollows, lined with sticks, coarse straws, bits of shell and other rubbish picked up in the vicinity; the rim of the nest was usually built up, more or less, elaborately like a gull's nest. The nests were almost always decorated with shells and often with feathers. Numerous pellets of fishbones, evidently cast up by the birds, were scattered about the nests. In marked contrast with the royal and Cabot's terns, the Caspian terns were very shy; they left their nests long before we reached them and flew about overhead, screaming loudly. They never offered to attack us and barely came within gunshot. I was told by my boatmen that I could not shoot any, as they were very shy and extremely hard to kill. I succeeded, however, in bringing down four, all I wanted, with five shots from my heavy 10-bore gun. We found several other scattering pairs on the other islands in the reservation, among the colonies of other sea birds, but usually the Caspian terns nested singly and a little apart from the others. Larger colonies, containing from 75 to 200 birds, have been found on some of these islands.

Mr. Stanley C. Arthur writes me that he found a colony of 119 pairs of Caspian terns breeding on a small islet, about an acre in extent, near Alexander Island, on the Louisiana coast, on July 3, 1918. The interior of the island was low and covered with marsh grass, but it was surrounded by a horseshoe-like rim of shells and sand, principally old oyster shells, on which the terns were nesting. Their nesting habits here were exceedingly primitive, for in no case did he find any evidence of nest building. Many eggs were merely lying on the shells; others were in slight depressions or hollows, which may have been made by the birds or may have been found already made. No nesting material had been brought in. The number of eggs in a nest was never more than two and often only one.



Grand Cochere, Louisiana. A. C. Bent.



Grand Cochere, Louisiana. A. C. Bent.

CASPIAN TERN.

FOR DESCRIPTION SEE PAGE 333.

On the Texas coast large colonies are found. Capt. B. F. Goss, in a letter to Major Bendire, says:

> We found the Caspian tern breeding only in Nueces Bay, and, although we examined 150 miles of coast, did not see a bird of this species more than a mile or two from the mouth of the bay. They breed on some small, low sandy islands near the middle of the bay. We took about 60 sets of eggs in all, mostly on one island not larger than 4 by 6 rods. As we approached this spot in a boat the birds rose about 8 feet and hovered a few moments, looking like a white cloud; then commenced circling, doubling, and turning in the most remarkable manner. It was a beautiful sight. As we approached they began plunging at the ground in great apparent excitement. My companion shouted, "They are breaking their eggs," and we hastened with all speed to the spot; found about 40 sets, a few of one, but mostly of two eggs. These lay on the bare sand without any attempt at a nest. At least one-quarter of the eggs had been broken by the birds in their frantic plunges, some only marked, in others the bill had passed clear through the egg. My companion said they had done the same thing in former years when he was collecting the eggs for culinary purposes, and thought they did it to prevent the eggs falling into our hands. It seemed to me like a frantic attempt to remove or conceal the eggs, but will not attempt to account for the actions of the birds, but deem the fact worth recording.

Some fine breeding colonies still exist in Michigan, of which Prof. W. B. Barrows (1912) writes:

> A few are seen, spring and fall, on Lakes Erie, Huron, and Michigan, and colonies of the birds have long been known to nest on certain islands belonging to Delta County, Michigan, lying in the entrance from Lake Michigan to Green Bay, and also on certain of the Beaver Islands, belonging to Charlevoix County, Michigan. At both these places the birds have been persecuted from time immemorial by fishermen and Indians, who use their eggs as well as those of other terns and gulls for food; and unless better protection is afforded, the extinction of the colonies can not be long postponed. The nests are placed on gravelly or shingly islands, are usually pebble-lined, and the two or three eggs (rarely four) are very variable in ground color, ranging from grayish white to pale olive, and more or less thickly spotted with brown and black, the spots commonly small and distinct." Mr. C. A. Reed (1904) refers to a colony on Hat Island, Lake Michigan, found by Mr. Charles L. Cass, on July 1, 1896, where "fully a thousand terns" were "nesting on about one acre." They had built no nests, but the two eggs were "laid in a hollow in the gravel."

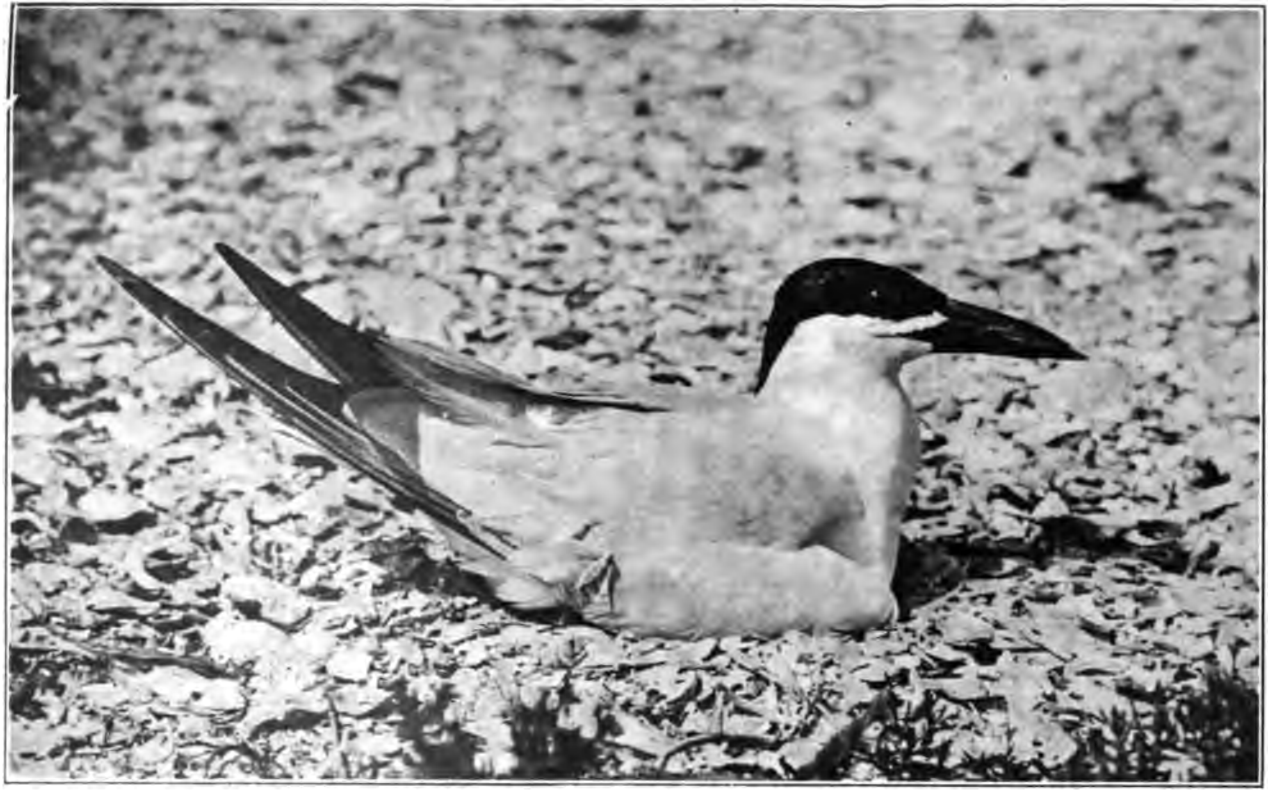
A distinctly different style of nesting is found in the big colonies of the Klamath Lake region of Oregon. Messrs. Finley (1907) and Bohlman have illustrated these colonies very fully in the numerous excellent photographs which they have taken. In one case they found as many as 500 nests of Caspian terns in a single colony. Here these terns nest in closely grouped colonies often in proximity with other species, such as California gulls, Forster's terns, Farallon cormorants, and white pelicans, on the floating masses of dead tules. The nests are merely hollows in the dead and decaying vegetation, lined with small broken bits of the same material. The birds seem to be much tamer here than elsewhere.

Eggs.—The Caspian tern raises but one brood in a season and lays from two to four eggs; two seems to be the commonest number, especially so in southern colonies; three eggs are commoner in northern colonies, where this number seems to prevail; four eggs are very rarely found. The eggs are distinctive and are more like gulls' eggs than other terns' eggs. In shape they are ovate or elliptical ovate. The shell is lusterless and sometimes rather rough. The ground color varies from "pinkish buff" or pale "warm buff" to very "light buff" or "cartridge buff." They are usually rather sparingly marked, sometimes evenly with small spots, sometimes with scattering large spots or irregular blotches, and occasionally with a few fantastic scrawls. The markings are in the darker shades of brown, "raw umber," "auburn," "mummy brown," or dark "sepia." The lighter types are often indistinctly spotted with "pale violet gray," or "lilac gray." The difference between these eggs and those of the royal tern is more easily seen than described. I think I could pick them out every time. The measurements of 48 eggs, in the United States National Museum and in the writer's collections, average 64.5 by 45 millimeters; the four extremes measure 73 by 44.5, 62.5 by 48, 58.5 by 45.5, and 64.5 by 42 millimeters.

About 20 days is said to be the period of incubation. Probably both sexes incubate, as is commonly the case with related species. Perhaps under favorable conditions, when the sun is not too hot, the eggs may safely be left for a time to be kept warm by the sun; the birds are sufficiently sensitive to changes in temperature to recognize such conditions.

Young.—Mr. Arthur has sent me some very interesting notes on the behavior of young Caspian terns in the colony referred to above, from which I quote as follows:

> Before the motor boat reached the shore it was quite evident that there were a number of young on this island, as the noisy approach of our boat caused the little ones to take to the water and swim rapidly away. In their aquatic journey the young terns were followed by their perturbed parents, who hovered in the air uttering hoarse cries. I landed and discovered a few of the smaller terns hiding in the grass and a number of eggs scattered on the rim of the shell. The Caspian terns who had eggs on the island were the first to return, soon followed by those parent birds whose young had taken to the grass for the purpose of concealment. While it is true that the majority of the small Caspian terns had taken to the open gulf and the distracted parents still hovered over them, I noted with my glasses that they were now guiding their babies back to the oyster shells that the little ones called home. The larger of the small terns showed in no little way their adaptitude for swimming, for a number of them were from one-fourth to one-half mile away, and I could see them being tossed up and down upon the salt waters, as there was



Alexander Island, Louisiana.

S. C. Arthur.

CASPIAN TERN.

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a good breeze blowing. They were stout little swimmers and soon paddled back to land.

With the return of the main colony of Caspian terns I had exceptional opportunities to watch the feeding of the young. The adult Caspians carry fish food to the island directly from the sea. The single fish was carried crosswise in the bill and seemed to be about from 2 to 3 inches in length. The fish are minnows of different species, and at no time did they seem to swallow this food before allowing the young to have the food; that is, the parent bird did not first eat and partially digest the finny delicacies. The male (?) wings his way in from the adjacent waters with the fish crosswise in his bill. The moment he lands on the island there is a commotion among all the young terns. As a rule the rightful heir would seize the fish before it would leave the parent's bill and unhesitatingly get the fish by the head; then with one or two gulps it would disappear head first, and nine times out of ten if the fish was of considerable length, say about 3 or 4 inches, the youngster would keel over on its back, with its little red feet frantically waving in the air, the fish's tail also waving about (for the caudal fin and that end of the fish protruded about three-quarters of an inch), while the process of digestion started. However, this display on the part of the little tern lasted only about three or four minutes, and while the little fellow was lying on its back it displayed the writhings of a person suffering from suffocation; but once back on its feet the little Caspian would besiege the parent bird for more fish.

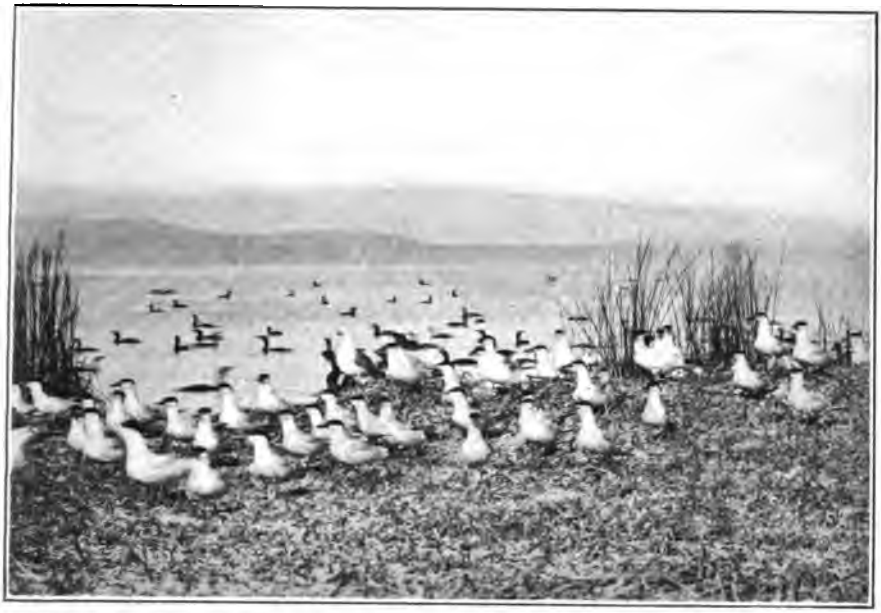
The adult Caspian has a very decided note, and while I fully appreciate no bird's call or cry can be properly imitated by the printed word, to me they called "ca-arr, ca-arr, ca-arr, ca-arrrrrrrr." The young know the call of its parents. I was very much amused in watching a little fellow that had selected a slight hole within 2 feet of my blind to take a sun bath. Here it would lie as still as death until it would hear the particular "ca-arr" of its own ma or pa. Then it would suddenly come to life, and, opening wide its little red beak, would chirp loudly in reply and rush about waving its little wing stumps in a most grotesque manner. The parents would make a few circles above their little one and alight or fly off after seeing it was safe. An incident that would frequently happen in the afternoon was that a little fellow would seek its hole and lie still until the "ca-arr" cry which it knew best would again be heard, then it would suddenly be galvanized into instant action. The young, when frightened, utter a peculiar whistling note.

Toward their own young the Caspian terns are very tender. However tender they are toward their own offspring they are extremely brutal toward the young of others, and I frequently saw the young ones mauled and flung about by the parent birds of other young. The young Caspians have no recreation save that of eating and sleeping. They do not flock together save when common danger threatens. In fact, according to my observations, it is extremely dangerous for little Billy Caspian to play with a little Charlie Caspian next door, for as sure as he does Charlie's ma is quite likely to knock the visitor down and jump on him with black feet, to say nothing of the thrashing she gives with the elbows of her wings. Such treatment arouses the parents of little Billy Caspian, who rush to the rescue with hoarse cries and there is much ado in the ternnery, in which red bills and white wings play a prominent part, and black crests pointed straight out behind.

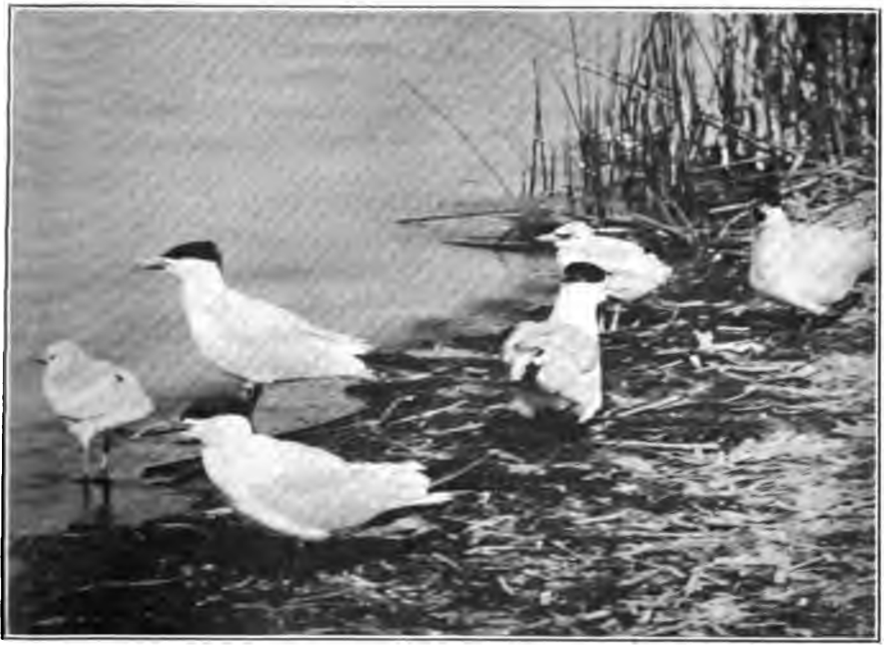
Plumages.—The downy young varies on the upper parts from dark grayish buff or "vinaceous buff" to "cartridge buff" or pale grayish white. The throat is very pale dusky and the remainder of the under parts are white. There are sometimes no dark markings, but usually the upper parts are more or less heavily spotted or mottled with dusky. As the young bird grows the color on the upper parts fades to almost white. The first plumage appears on the scapulars and back. In the juvenal plumage the young Caspian tern is distinctively marked, differing from all other young terns in corresponding plumages. The most striking character is the black crown, which in all other terns is largely white; in the young Caspian the entire upper half, or more, of the head is black, including the lores and cheeks, down to a line running from the commissure straight back to the occiput; the black is more or less relieved on the forehead and crown by whitish or grayish streaks. The feathers of the upper parts, back, scapulars, and wing-coverts are basally "light gull gray," but they are so broadly edged or tipped with pale buffy shades, "cartridge buff," or "tilleul buff," that they impart this color to the upper parts. The scapulars are broadly banded with black, two bands on each feather, and the feathers of the back and coverts are more or less barred or spotted with black. The under parts are white.

When the young bird attains its full growth, a partial molt, involving most of the contour feathers, begins early in September. The feathers of the fore back are now heavily tipped with dusky, forming an interscapular dusky patch; the scapulars are variegated with hastate dusky markings and the tertials are doubly banded with dusky near the tips; the rectrices are mottled with dusky near the tips, more so centrally and less so laterally; and the lesser wing coverts are mottled with dusky. This might be considered the first winter plumage though it is more properly a transition stage from the juvenal plumage for it soon disappears by wear, fading, or molt. Later in the fall young birds assume the pearl gray mantle and can be distinguished from adults only by the dusky in the lesser wing-coverts and the mottled tails. A complete molt in early spring renders old and young indistinguishable in March. Some birds retain the mottled crown until May.

Adults have two complete molts—the prenuptial in February and March, producing the full nuptial plumage, and the postnuptial in August and September, producing the adult winter plumage with the white-streaked crown, the pearl gray mantle and wing-coverts, and the pure gray tail. Adults usually have white foreheads and more white in the crown than young birds; they also have larger bills. The postnuptial molt of adults begins before the end of the breeding season, sometimes as early as June, with the appearance of white feathers in the black crown. The outer primaries are molted last.



Lower Klamath Lake, Oregon. W. L. Finley.



Lower Klamath Lake, Oregon. W. L. Finley.

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Food.—The Caspian tern secures its main food supply, which consists almost wholly of small fish, by plunging headlong into the water, often disappearing entirely under the surface. It probably feeds to some extent on shrimps and other forms of surface swimming aquatic life. Dr. P. L. Hatch (1892) says that its favorite food is "the fresh-water mussels, with which the margins of the marshland streams and lakes abound," while on its spring migration in Minnesota. Several writers have stated that it feeds on the eggs and young of other birds, a gull-like trait not shared by the other terns.

Behavior.—The flight of the Caspian tern is strong, swift, and graceful, but heavier and more gull-like than that of the smaller terns. Its general manner of flight is, however, decidedly tern-like, as it flies along in search of food, with its bill pointed downward, pausing to hover for an instant and then plunging vigorously down into the water. When fishing it usually flies only a few yards above the water, but when traveling it flies at a great height, with its bill pointing straight forward, making rapid progress, even against a strong wind. It has a broad expanse of wing, and is more given to soaring than the other terns. I have seen it soaring in great circles, mounting higher and higher in the air, as the gulls are wont to do. It so closely resembles the royal tern that the illustrious Audubon never detected the difference, but it can be recognized by its heavier, more stocky build, by its heavier flight, by its shorter and less deeply forked tail, and by the larger amount of black in the primaries, which look wholly black when seen from below, whereas those of the royal tern seem to be largely white or grayish.

The cry of the Caspian tern is entirely unlike that of the royal tern and quite different from that of any of the Laridae. Its ordinary note is a hoarse, croaking " kraaa " on a low key, loud, harsh, and grating. A shorter note sounding like " kow " or " kowk " is often heard on its breeding grounds, where it also utters, when angry, a loud, vehement, rasping cry of attack.

On its southern breeding grounds, where it is usually larger and stronger than its associates, it has few enemies. It has been said to eat the eggs and young of other birds, but I have never seen any evidence of this habit, and I believe that it seldom, if ever, attacks them. Audubon (1840), however, saw some evidence of its pugnacity on the Labrador coast. He says:

> Until that period I was not aware that any tern could master the *Lestris Pomarinus*, to which, however, I there saw the Cayenne tern give chase, driving it away from the islands on which it has its eggs. On such occasions I observed that the tern's power of flight greatly exceeded that of the jager; but the appearance of the great black-backed gull never failed to fill it with

> dismay, for, although of quicker flight, none of the terns dared to encounter that bird any more than they would venture to attack the frigate pelican in the Floridas.

The Caspian tern has suffered but little from the hand of man; it is too shy, too hard to kill and not sufficiently abundant to tempt the plumage hunter. Some of the northern colonies, particularly those in Lake Michigan, have been regularly and persistently robbed of their eggs for food until some of them have been materially reduced in numbers.

Fall.—The Caspian terns leave their northern breeding grounds during the latter part of September or the first half of October. During recent years they have been growing scarcer on the New England coast, probably because their numbers have been decreasing on their Labrador breeding grounds. They were evidently more regular in their appearance formerly, for Mr. Brewster (1879) wrote:

> They come down from their northern breeding-grounds during the latter part of September and for several weeks, at least, are to be found in moderate numbers all along our seaboard. I have observed them at various points from Ipswich to Nantucket. At the latter place, upon one occasion, six individuals were seen fishing in the harbor near the town. As to their wintering within New England limits, I can offer only negative evidence, but that points to the inference that they pass farther south with the approach of severe weather.

Winter.—The Caspian tern winters, more or less regularly, as far north as South Carolina, but it is more abundant in the Gulf of Mexico in winter. Messrs. Beyer, Allison, and Kopman (1906) say of its winter habits on the coast of Louisiana that "it occurs singly or in flocks of two or three, and associates freely with other gulls and terns, often congregating about the oyster and shrimp canneries. It never occurs far from the coast."

On the California coast it seems to be rare in winter.

DISTRIBUTION.

Breeding range.—In North America in widely scattered localities, mainly on the coasts or large lakes. East to southern Labrador (near Cape Whittle), Virginia (Northampton County), and South Carolina (Bulls Bay). South to the coast of Louisiana (numerous islands) and southern Texas (Cameron County). West to central California (Sutter Basin) and southern Oregon (Klamath Lakes). North to Great Slave Lake (Fort Rae), central Manitoba (Lakes Winnepegosis and Winnipeg), and Lake Michigan (Green Bay). Eastern Hemisphere birds have been separated as distinct subspecies.

Breeding grounds protected in the following national reservations: In Oregon, Klamath Lake and Malheur Lake; in Wisconsin, formerly Green Bay (Gravel Island, 1905 and earlier).[1]

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[1] See Ward, Bull. Wis. Nat. Hist. Soc., vol. 4, 1906, p. 113.

Winter range.—South Atlantic and Gulf coasts, from South Carolina to Texas and Mexico. Pacific coast, from San Francisco Bay to Lower California (La Paz) and western Mexico (Manzanillo).

Spring migration.—Early dates of arrival: Pennsylvania, Erie, April 26; New York, Canandaigua, April 28; Rhode Island, Ocean View, May 10; Prince Edward Island, May 13; southern Labrador, Natashquan, May 31; Nebraska, Lincoln, May 2; Iowa, March 10; Michigan, Lake St. Clair, April 25; Wisconsin, Milwaukee, April 10; California, Fresno, April 3 to May 6.

Fall migration.—Transient dates: Massachusetts, September 6 to 20; New York, Long Island, September 7 to 13; Pennsylvania, Marietta, September 21; Virginia, Four-Mile Run, October 4; Michigan, Ann Arbor, September 5; Wisconsin, Delavan Lake, September 19; Iowa, September 9 to October 15; California, Madera County, September 28 to October 2, and Stanislaus County, September 4 to October 6.

Casual records.—Recorded in summer east to Newfoundland (said to have bred at Sandy Lake in 1912) and north to the mouth of the Mackenzie River (Harrison Island, August 1, 1848). Taken in fall in Washington (Westport, October 5, 1917).

Egg dates.—Lake Michigan: Twenty-eight records, May 25 to July 1; fourteen records, June 5 to 22. Texas: Fifteen records, April 8 to June 18; eight records, May 6 to 30. California: Eight records, May 20 to 25.

STERNA MAXIMA Boddaert.

ROYAL TERN.

HABITS.

Although the royal tern is a splendid bird it seems to me that the name "royal," as well as the specific name *maxima*, should have been applied to its near relative, the Caspian tern, which is both larger and more aggressive, a real king among the terns. The two species so closely resemble each other that so good a naturalist as Audubon did not recognize them as distinct, confusing the two under the name, Cayenne tern.

Throughout the southern portion of its range, from Florida and the Gulf of Mexico southward, the royal tern is resident throughout the year. Northward to Virginia it occurs as a summer resident only, and beyond that merely as a straggler. In former years royal terns bred abundantly on the coast of Virginia. Mr. Robert Ridgway (1880) in the summer of 1880 found and reported a breeding colony of some 500 nests, but in the persecution which followed during the next 20 years this species suffered with the other terns which were slaughtered for the millinery trade. On account of their large size royal terns were not in demand for ladies' hats, but their eggs, being large and palatable, were collected for food in great quantities. Persistent nest robbing and constant shooting near their breeding grounds discouraged the birds and frightened them away. The reports of the wardens in 1901 and 1902 indicated that the colonies were much depleted until, in 1903, Capt. N. B. Rich stated, in Mr. Dutcher's (1903) report, that he "did not see any royal terns, so they probably have been exterminated so far as Virginia is concerned." During my visit to Cobb's Island in 1907 I did not see any royal terns, but was told by the fisherman that a few are seen occasionally. Since that time conditions have evidently improved under protection, for Mr. Harold H. Bailey (1913) says:

> The royal terns are much more numerous, a large colony still breeding on one of our coastal islands. They did, however, for a number of years during the overwhelming destruction of some of the following species for millinery trade, desert our coast entirely, but it has only been within the last few years that they have become established as breeding birds once more.

Spring.—On its spring migration the royal tern, according to Bailey (1913), reaches Virginia "the last week in May," although, according to Coues (1877), it arrives in North Carolina "early in April." Its migration is so limited that its movements are probably very deliberate and perhaps quite erratic or variable. I have never seen its courtship performance and can find nothing about it in print.

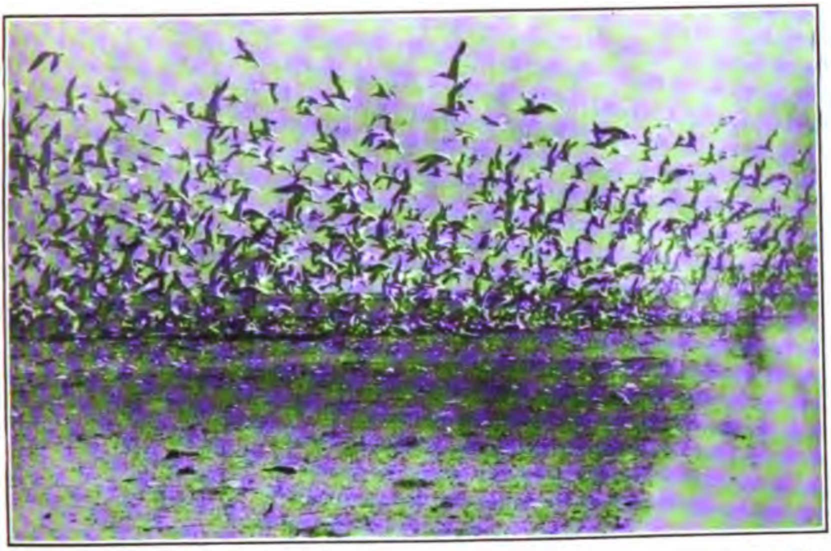
Nesting.—An old-time colony on the Virginia coast is described by Ridgway (1880) as follows:

> Allowing the birds sufficient time to deposit their eggs, we visited the locality two days afterwards, and found an area of perhaps one-eighth of an acre completely covered by their eggs, it being impossible to walk through the nesting site without crushing a greater or less number, many eggs having been covered by drifting sand. Comparatively few pairs had deposited their full complement, a large majority of the nests containing but a single egg. Still, more than 500 nests were counted, while our man declared that not one-third the number of birds seen by him on his former visit were there, the greater part having been frightened away by the shots which he had fired at them two days before.

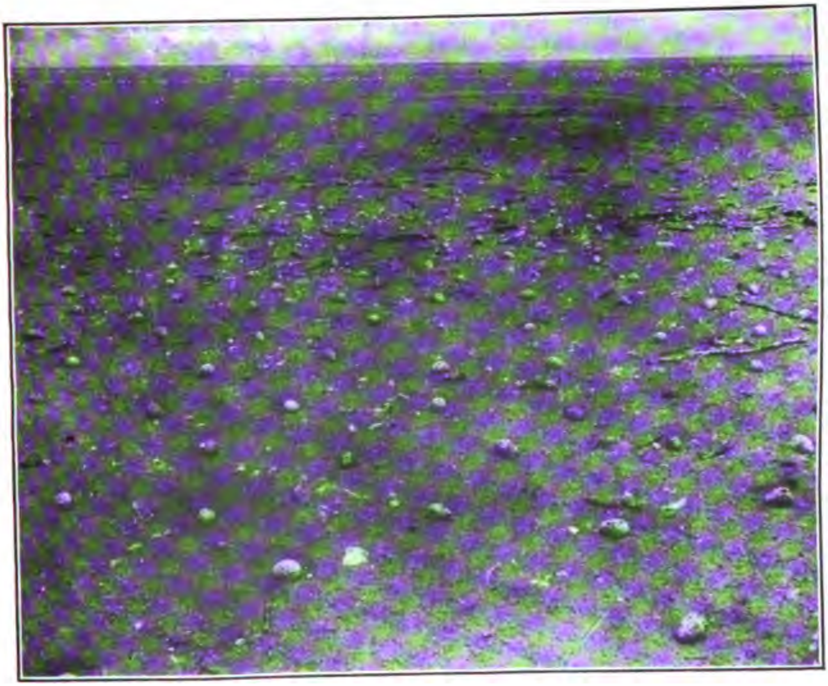
In Virginia, the bird is known as the "gannet striker" or "gannet."

Mr. B. S. Bowdish (1910) and Mr. P. B. Philipp discovered four breeding colonies of royal terns on the coasts of the Carolinas in 1909, as follows:

> The first was situated on Vessel Reef, a low sand key in Bulls Bay, South Carolina, visited on June 12. About 75 birds were seen there and nesting had just begun, three fresh eggs being found. The second colony was on Royal Shoal, Pamlico Sound, North Carolina. Here, instead of the enormous numbers of the preceding season, estimated at some 7,000 birds, only 50 were found. On



Grand Cochere, Louisiana A. C. Bent.



Grand Cochere, Louisiana. A. C. Bent.

ROYAL TERN.

FOR DESCRIPTION SEE PAGE 234.

June 24 one fresh egg was noted. The third and largest colony was found on June 26, on Miller Lump, a small, low sand bar in Pamlico Sound, lying in a broad expanse of very shallow water. This colony comprised 1,000 adult birds. The nesting was advanced; some 258 good eggs were counted, usually one egg to a set, though a few doubles were found. There were also many young, some of which were able to run about. All the eggs were advanced in incubation. The fourth breeding colony visited was on Davis Lump, a small sand bar near Miller Lump. Here about 60 pairs of birds were breeding. Thirty-two eggs were counted, for the most part advanced in incubation. Half a dozen newly hatched young were also seen.

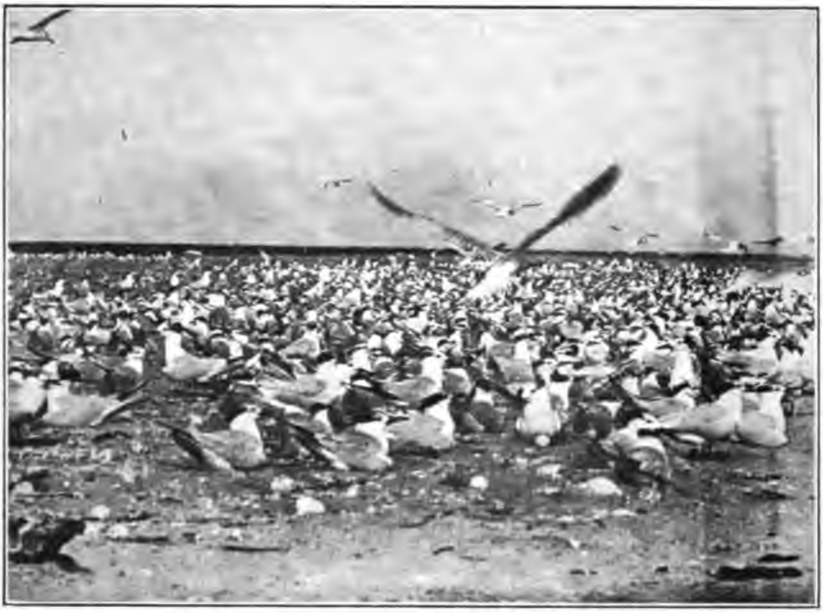
My own experience with the nesting habits of the royal tern was gained in the large protected colonies of the Breton Island reservation, off the coast of Louisiana, where the birds have certainly flourished during the recent years. They are now safe from the depredations of man, but they still suffer occasionally from the destruction of their breeding colonies by the elements. The combination of high winds or storms with a high course of tides often results in the flooding of the low sandy islands on which they breed and the washing away of the eggs or young; but such wholsesale damage is generally repaired by a second attempt at nesting.

On June 18, 1910, with Warden W. M. Sprinkle, in his patrol boat, I visited one of these colonies. Sailing due south from what seemed to be the outer islands, we headed straight out to sea and were soon out of sight of land. After several hours of apparently aimless sailing Captain Sprinkle pointed out on the horizon a distant sand bar, and as we drew nearer we could see with our glasses a cloud of white specks hovering over it, so we knew that the terns were nesting there as expected. They had been washed off one of the other islands earlier in the season and had come here to make their second attempt at nesting. The island, which is known as Grand Cochere, was merely a low, flat sand bar, with no vegetation on it whatever, only 2 or 3 feet above high-water mark at its highest part. It was nearly triangular in shape, perhaps half a mile long, and surrounded by dangerous sandy shoals. On an old wreck at one end 30 or 40 man-o'-war birds were perched in a long black row; a large flock of brown pelicans were resting on one of the sand bars; and at night thousands of black terns came in to roost on the beaches. There were several small nesting colonies of black skimmers, and three or four small mixed groups of royal and Cabot's terns, scattered over the island with their eggs lying in the dry, hot sand, as well as a few scattering pairs of laughing gulls and a little colonly of 40 nests of Caspian terns at the eastern end. But the main population of the island was concentrated in an immense, closely packed nesting colony of royal and Cabot's terns on the south side. As I approached this colony, over the level sandy plain on which it was spread out, the birds all arose at once, as if impelled by a common impulse, with a great roar of thousands of wings, a dense cloud of screaming birds, and a bewildering moving picture of flashing black and white. As the birds were shy my attempts at photography resulted in only a few distant snapshots of the colony as a whole; so I set up my blind in the midst of the colony and left it overnight for the birds to get accustomed to it.

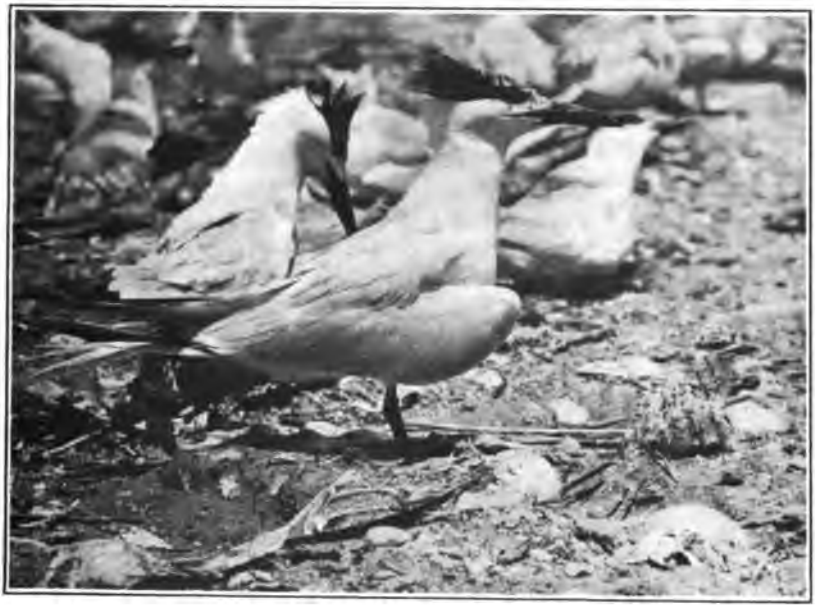
On my return the next morning I was delighted to find that the terns had learned to regard my blind as harmless and had settled down on their nests all around it. Walking up to the blind, with two companions, I concealed myself inside of it with my cameras, and the other two men walked away. The birds, thinking that all of us had gone, immediately returned and assumed their regular vocations. For two or three hours I sat there unobserved and watched the activities of that populous colony. All around me the flat sandy plain was dotted with eggs, a single egg in each little hollow in the sand at regular distances, just far enough apart so that the birds could not touch each other when sitting. It was a hot, sunny day, probably too hot for the eggs to be left uncovered, so the birds spent most of their time incubating; but there were many birds standing beside their sitting mates. There was not sufficient difference between the sexes for me to determine whether both sexes incubate or not, but probably they relieve each other occasionally. There were no young in the colony, so I could not study their method of feeding them. Life is never dull in a large bird colony and the birds are never still; some were coming and some were going all the time; there was a constant babel of voices and numerous little squabbles occurred, if an incoming bird alighted too near its neighbor. They were so close together that they could hardly spread their wings without interfering. An air of nervous excitement seemed to pervade the colony all the time, as in a crowd of women at an afternoon tea, and at frequent intervals, without any apparent cause, a large portion of the colony would rise suddenly and simultaneously, as if frightened, fly around for a minute or two, all screaming excitedly, and then all would settle down again as if nothing had happened.

I counted the nests in a measured area and then roughly measured the whole colony, from which I estimated that it contained, at least, 3,500 nests. There were a hundred nests in a space four yards square; certainly this was a densely packed colony of a highly gregarious species.

The colony described above may be considered as typical of the species, which almost always nests in similar situations in closely populated colonies. The nest is nothing more than a slight hollow in the sand, without any attempt at a lining. I believe that the normal set consists of two eggs; very rarely three are found and four



Grand Cochere, Louisiana. A. C. Bent.



Louisiana. A. M. Bailey.

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eggs have been recorded, though these were probably laid by two birds. Often only one egg is laid, and where the first set has been destroyed, only a single egg is laid for the second set. Two eggs are more often found in northern colonies, but in the southern portion of its range this tern usually, or at least frequently, lays only one egg for the first set. Only one brood is raised in a season, so far as I know.

Eggs.—The eggs of the royal tern are usually quite characteristic and are not likely to be mistaken for anything else. They are quite different from those of the Caspian tern. In shape they vary from ovate to elongate ovate or even cylindrical ovate, but average about elongate ovate. The shell is smooth but without luster until it becomes worn by incubation. The common types have a very light ground color, practically white, varying from "light buff" or "ivory yellow" to pure dull white. Darker shades are rare, but I have a few in my collection which vary from "clay color" or "cinnamon buff" to "light buff." The greener types, "olive buff" or "yellowish glaucous," are still rarer. The eggs are usually quite evenly spotted with small, dark-colored spots, sometimes with fine dots and sometimes with large, bold, heavy blotches; very rarely they are marked with irregular scrawls. The markings include only the darkest shades of brown, "chestnut brown," "bister," or "clove brown," and often they are practically black. The spots have a washed-out appearance on the edges. On many eggs there are underlying spots of "lavender gray" or "pale violet gray," often in washed-out splashes. Sparingly spotted or even immaculate eggs are occasionally found. The measurements of 54 eggs, in the United States National Museum, average 63 by 44.5 milimeters; the eggs showing the four extremes measure 74.5 by 48.5, 57.5 by 43, and 63.5 by 40.5 millimeters.

Plumages.—In a series of 10 downy young royal terns, in the author's collection, no two are alike, and there are, at least, three distinct types of coloration. In the palest type the color of the upper parts varies from "light pinkish cinnamon" to "pale pinkish buff," which becomes paler on the throat and sides and almost white on the belly. Some specimens are nearly immaculate, but there are always a few small black-tipped filaments of down on the rump and often a few on the head. The character of the down is peculiar; on the head is rather stiff and hair-like, but on the back and flanks each filament stands out by itself, round and soft like chenille at the base and tapering to a fine point at the end. The bill and feet are light yellowish flesh color in the dried skin.

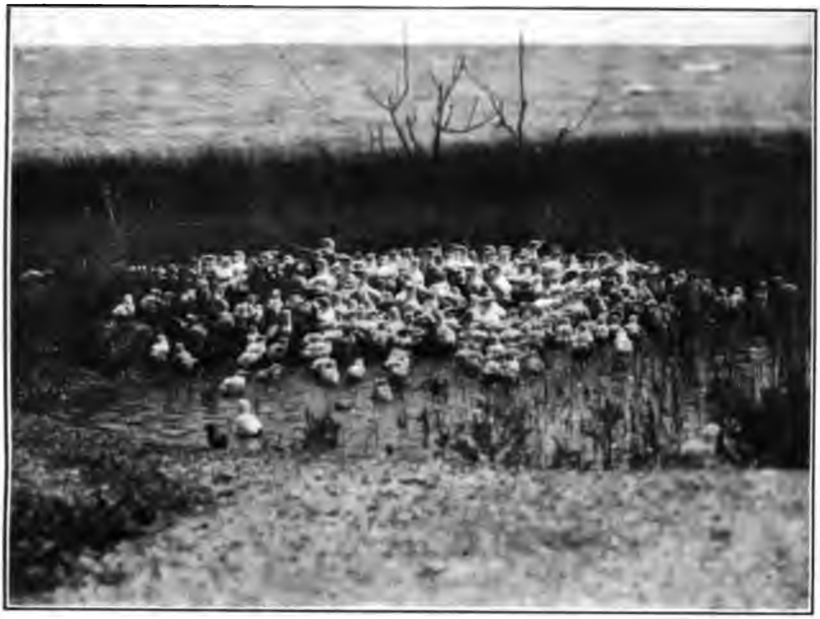
In the mottled type the color varies from "light pinkish cinnamon" to "cartridge buff" above, shading off to the latter or to nearly white below. This is more or less heavily spotted with black, more or less evenly, over all the upper parts, including the sides of the head, throat, and flanks. The spots are very distinct and include either the tip or the whole of the filament. The bill is light colored, and the feet may be light colored, as in the preceding type, or grayish or nearly black.

In the dusky type the ground colors are as described above, but they are largely, and sometimes almost wholly, concealed on the head, throat, back, wings, rump, and flanks with black or dusky filaments. Often the forehead and lores are solid black. The bill in this type has a subterminal black tip on one or both mandibles. The feet show both light and dark phases without any correlation with the other colors; in fact, my darkest specimens have the lightest feet. A larger series would probably show a great variety of intermediates between these three types and perhaps other types.

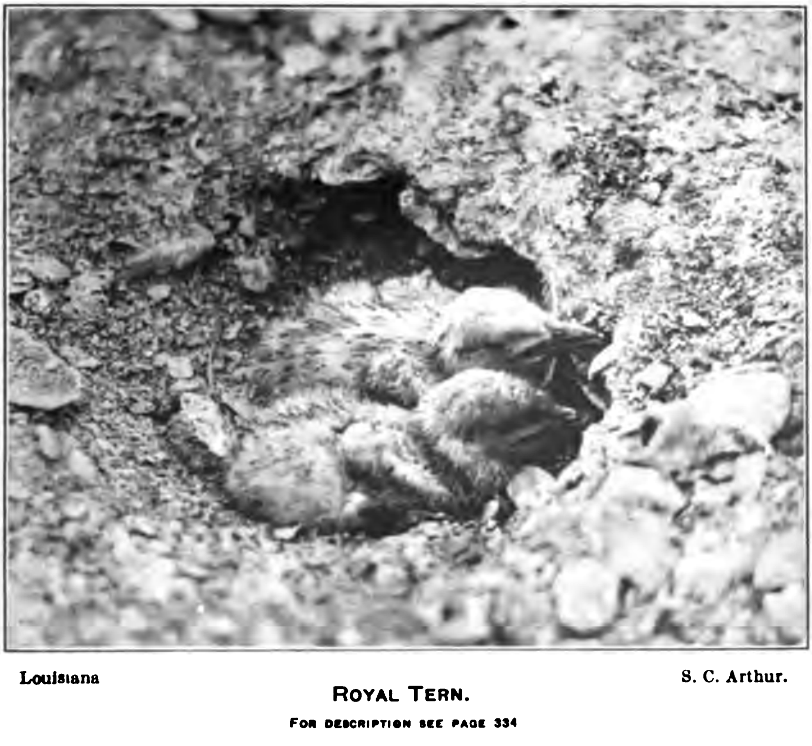
The juvenal plumage is fully acquired before the young bird is fully grown. It is entirely unlike that of the Caspian tern; the upper parts are mainly white with a faint creamy tinge, the feathers centrally tinged with light gray and with many narrow, dusky shaft-streaks; the primaries and secondaries are "slate gray" or lighter, edged with white and the tail feathers are chiefly dusky, with white tips and white toward base of inner web; the underparts are pure white; the feathers of the crown have narrow, blackish shaft-streaks, becoming broader on the nape and auriculars, forming a dusky collar. This plumage is worn until about the last of August, when the post-juvenal molt begins. The wings and tail are retained and will serve to distinguish the young bird, but otherwise the first winter plumage is the same as the adult, the contour feathers being molted during the fall. A complete prenuptial molt occurs in March, at which the adult nuptial plumage is apparently assumed, but perhaps young birds do not acquire such a completely black pileum as adults.

Adults have two complete molts, the prenuptial in March or earlier and the postnuptial mainly in August and September, but often prolonged into October or even November, the outer primaries being molted last. The prenuptial molt, which produces the clear black pileum, is usually but not always soon followed by a partial molt on the head, which produces the white forehead, more or less variable in extent. The full black pileum seems to be the courtship plumage, and the white forehead the prevailing nesting plumage. Only a very small percentage of incubating birds have the pileum wholly black. In the adult winter plumage the forehead is white, the crown mainly so, but streaked with black, and only the occipital crest is mainly black. The tail is shorter and more tinged with gray than in spring.

Food.—The food of the royal tern consists almost wholly of small fish, up to 4 inches in length, which it catches by plunging down into



Louisiana S. C. Arthur.



Louisiana S. C. Arthur.

ROYAL TERN.

FOR DESCRIPTION SEE PAGE 334

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the water, in much the same way as the smaller terns. Mr. Philip H. Gosse (1847) thus describes the process:

> High above the water we discern a bird, the snowy whiteness of whose plumage contrasts with the blue sky. He flies rapidly round and round in a large circle, quickly flapping his wings without intermission. Suddenly he arrests his flight, flutters his wings in rapid vibration, as he looks downwards, but in a moment proceeds as before. It was doubtless a fish near the surface, but which disappeared before he could descend. Presently he again stops short, flutters; then bringing the elbow of the wings to a right angle, descends perpendicularly, but with a singular turning of the body, so as to present now the back, now the belly, alternately, to the observer; not, however, by a rotation, but irregularly, and as if by jerks. But his purpose is again frustrated; for on nearly reaching the surface he recovers himself with a graceful sweep and remounts on flagging wing. Again he circles, and again, and again stops; at length, down he swoops, disappears with a splash, and in a moment breaks, struggling, from the wave, and, as if to rise burdened with prey were difficult, flags heavily near the surface, and circling slowly round, gradually regains his former altitude.

Audubon (1840) says:

> They alight on the banks of raccoon oysters, so abundant in the inlets, and are seen in company with the semipalmated snipe and the American oyster-catcher, searching for food like these birds, and devouring crabs and such fishes as are confined in small shallow pools. These they catch with considerable agility, in a manner not employed by any of our other terns.

Mr. A. W. Anthony (1906) says that they feed on herring "swimming in compact flocks near the surface," and "secure them by approaching the school from behind and flying near the surface of the water, making repeated, quick dips into the school." They also eat shrimps.

Behavior.—The flight of the royal tern is much like that of the common tern, but somewhat less bouyant, as might be expected in a larger and heavier bird. On the wing it is lighter in appearance than the Caspian tern, as it is more slender, and it has a longer and more deeply forked tail, with less black in the outer end of the wing. Audubon (1840) says:

> When traveling, these birds generally proceed in lines; and it requires the power of a strong gale to force them back, or even to impede their progress, for they beat to windward with remarkable vigor, rising, falling, and tacking to right and left, so as to seize every possible opportunity of making their way. In calm and pleasant weather they pass at a great height, with strong unremitted flappings.

Though webfooted and perfectly capable of swimming, these and other terns seldom alight on the water and are very poor swimmers. Their feet are rather small and weak, as they depend almost entirely on their long wings for locomotion.

The voice of the royal tern is not so loud and raucous as that of the Caspian and is pitched on a higher key. The note most often heard, when disturbed on its breeding grounds, is a loud penetrating squawking cry, audible for a long distance, like the syllables, "quak," "kak," or "kowk." Another note on a lower key sounds like the bleating cry of a sheep. It also has a very musical, rolling call, a soft liquid whistle, "tourrrreee," suggestive of the melodious rolling whistle of the upland plover.

This highly gregarious species is a sociable and harmless neighbor on its breeding grounds, where it is intimately associated with Cabot's terns, black skimmers, and laughing gulls, which it apparently never molests. Its nests are preyed upon to some extent by the laughing gulls, though I believe that the royal tern is more than a match for the gull, as a rule. The royal tern is frequently seen fishing in company with the brown pelican, which it is said to rob occasionally by seizing the fish from its capacious pouch. The robber often pays the penalty for his crime by giving up his ill-gotten booty to the man-of-war bird, that arch robber of the southern seas, ever ready to pounce upon any bird weaker than itself and make it drop its catch.

Fall.—In September the short migration flight begins, which is hardly more than a withdrawal from the northern portions of its breeding range, though its winter wanderings carry it to the Bahamas and the West Indies. The southward movement is deliberate. It leaves the coast of Virginia about the middle of September and lingers on the coasts of the Carolinas until the end of November. In its winter quarters, from Florida and the Gulf States southward, it prefers to frequent the harbors, estuaries, mouths of rivers, and the vicinity of sand shoals, where it may be seen fishing in company with brown pelicans, man-o-war birds, laughing gulls, and other terns, or perched on convenient spar buoys, or resting and dozing on the warm bare sand bars. It also roams inland to some extent in winter, visiting fresh water lakes and ponds. It is common along the Pacific coast in winter from Monterey Bay southward, in the harbors and about the islands, as well as in some of the lakes near the coast.

DISTRIBUTION.

Breeding range.—South Atlantic and Gulf coasts, from Virginia (Northampton County) to southern Texas (Cameron County). Some of the Bahamas (Berry and Ragged Islands, etc.); and many of the West Indies (Isle of Pines, Porto Rico, Dominica, Grenada, Carriacou, etc.). Pacific coast of Lower California (Natividad Island) and Mexico (Isabella Island).

Breeding grounds protected in the following national reservations: In Louisiana, Breton Island, Shell Keys, and Tern Islands.

Winter range.—From central Florida (Micco) and from the coast of Louisiana southward, including the Bahamas and West Indies, along the east coasts of Central and South America to Patagonia. On the Pacific coast, from central California (San Francisco Bay) southward to Peru. Also on the west coast of Africa, from Gibraltar to Angola.

Spring migration.—First arrivals reach North Carolina early in April, and Virginia during the last week in May.

Fall migration.—Last birds leave Virginia about the middle of September, but they linger in North Carolina until late in November.

Casual records.—Stragglers in summer wander northward along the Atlantic coast, sometimes as far as Massachusetts (Nantucket Island, July 1, 1874).

Egg dates.—North and South Carolina: Thirty records, May 15 to June 28; fifteen records, June 20 to 26. Texas: Sixteen records, April 8 to June 18; eight records, May 13 to 20. Mississippi and Louisiana: Eight records, May 18 to June 19; four records, May 19 to 29.

STERNA ELEGANS Gambel.

ELEGANT TERN.

HABITS.

This beautiful tern well deserves its name, for in color, form, and behavior it is certainly one of the most elegant of our sea birds, the most exquisite member of the charming group of "sea swallows." Unfortunately, owing to its remote habitat, it has been seen in life by very few ornithologists. Many handsome specimens have found their way into collections, but the dried skin can give but a faint impression of the grace and beauty of the living bird. Not all of the few collectors who have explored the coasts of the peninsula of Lower California have succeeded in finding it, and still fewer have seen it on its breeding grounds. Consequently very little is known of its life history and habits. Probably Mr. Wilmot W. Brown, jr., has been more successful than anyone else in the pursuit of this rare species, and we are indebted to him for practically all that we know in regard to its nesting habits.

Nesting.—Mr. Brown obtained a fine series of the eggs of this species for Col. John E. Thayer (1911*a*), who published a brief account of its nesting habits on Cerralvo Island, Lower California. He says:

> The nests were slight depressions in the sand on the beach about 20 yards from the surf on the protected or land side of the island.

The eggs "were taken April 9 and 15, 1910. Most of the eggs were slightly incubated. One egg is generally what they lay, sometimes two, but only rarely."

Eggs.—Mr. Thayer's beautiful series of 18 sets, of one egg each, makes an attractive display of striking variations. The eggs suggest those of the Cabot's tern rather than those of the royal tern. They vary in shape from ovate to elongate ovate. The ground color is very light, varying from "pinkish buff" or pale "pinkish buff" to pure white, with a decided tendency toward the latter. The commoner types are spotted like eggs of the royal tern, but more sparingly. Some are very heavily and boldly marked with great irregular blotches of various shades of the darker browns, often almost black. These dark markings frequently have the appearance of having been washed out on the edges. One pink egg is uniformly covered with small spots of very dark brown and pale shades of "violet gray."

Another pink egg is blotched with "pale violet gray," overlaid with large handsome blotches of "chestnut," "chocolate brown," and "chestnut brown"—a beautiful egg. The measurements of 27 eggs, in various collections, average 53.5 by 38 millimeters; the eggs showing the four extremes, measure **57** by 39, 55 by **40.5**, and **51** by **35.5** millimeters.

Plumages.—As I have never seen a specimen of the downy young or any birds in the immature plumages, I can not say much in regard to the sequence of plumages to maturity, but it seems reasonable to assume that all the plumage changes are similar to those of the closely related royal tern.

Behavior.—I have never seen the elegant tern in life and can not find anything in print regarding its habits, but probably its behavior is not very different from that of the royal tern, which it so closely resembles in appearance.

Fall.—The elegant tern is another one of the Lower California species, which has adopted the peculiar habit of migrating northward at the close of the breeding season, wandering occasionally as far as Monterey or San Francisco.

DISTRIBUTION.

Breeding range.—So far as known only in the Gulf of California, Mexico (San Pedro Martir, and Cerralvo Islands, and near Guaymas).

Winter range.—From central California (San Francisco Bay) southward along the coast to Chile (Coquimbo Bay, Valdivia, and near Valparaiso).

Spring migration.—Returns to its breeding range in March and April. Lower California, La Paz, April 12 to 27.

Fall migration.—Southward to Peru (Callao Bay) in September. Northward to California at about the same time: San Francisco Bay, September 17; Monterey Bay, September 22 to October 29; Point Pinos, September and October.

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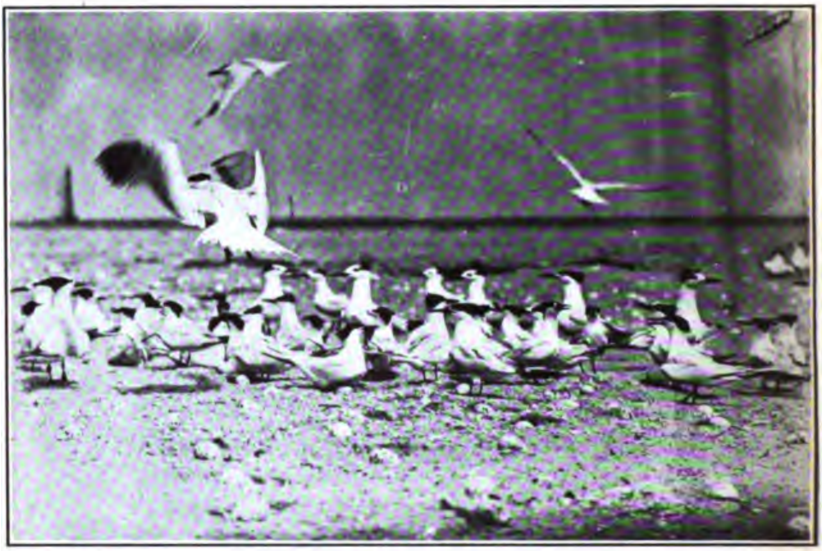
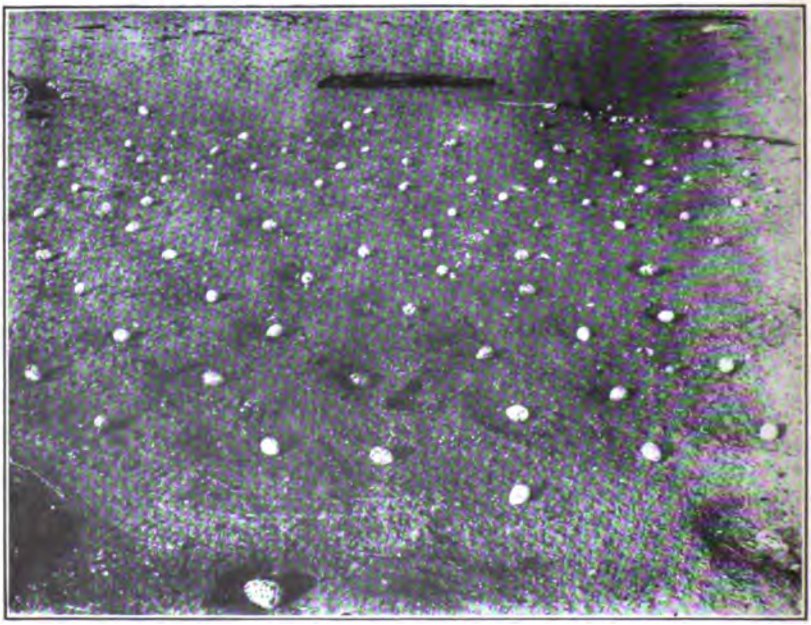


Grand Cochere, Louisiana. A. C. Bent.



Grand Cochere, Louisiana. A. C. Bent.

CABOT'S TERN.

FOR DESCRIPTION SEE PAGE 334

Casual records.—Accidental in Texas (Corpus Christi).

Egg dates.—Gulf of California: Seven records, April 1 to May 1; four records, April 9 to May 1.

STERNA SANDVICENSIS ACUFLAVIDA Cabot.

CABOT'S TERN.

HABITS.

Among the sandy islands and shoals of our southern Atlantic and Gulf coasts we find this fine tern, everywhere intimately associated with its larger relative, the royal tern; like Damon and Pythias, they are always together and seldom is one found without the other. The same resorts seem to be congenial to both, but there is probably some stronger bond of friendship which we do not understand. Our American bird is only subspecifically distinct from the Sandwich or Boy's tern of the Eastern Hemisphere, differing from it in the color pattern of the primaries. This makes the species cosmopolitan and gives it a wide range. The European bird ranges farther north in summer than ours, which may be due to the difference in climate.

What little evidence we have on the subject seems to indicate that this species has extended, and is perhaps still extending, its breeding range northward along our Atlantic coast. This, if it is a fact, is both interesting and remarkable when compared with the histories of other species, nearly all of which have been reduced in numbers and restricted in range. In Audubon's time, Cabot's tern was not supposed to breed north of Florida. Royal Shoal Island, in Pamlico Sound, North Carolina, had been protected and watched carefully, as a sea-bird breeding resort, for five years before Mr. T. Gilbert Pearson (1908) discovered the first breeding colony, over 20 pairs, of Cabot's terns on this island on June 25, 1907. Mr. Pearson says, in reporting the incident:

> This bird has not previously been noticed breeding among the protected colonies in the State, and in fact, so far as I am aware, there have been no records of its occurrence in North Carolina, except one reported by Dr. Louis B. Bishop (MS.), from Pea Island, August 22, 1904.

Since that time I believe that Cabot's tern has bred regularly on the North Carolina coast and in larger numbers. And now comes the latest news from Mr. Harold H. Bailey (1913), telling of the extension of its breeding range into Virginia. He says:

> This is an extremely rare bird on our coast, and it was not until the summer of 1912 that a set of two eggs of this species was secured from one of our coastal islands. As there has been a small colony of these birds breeding on the North Carolina coast for the last few years, the birds with us are probably stragglers from that colony.

Spring.—North of Florida this species is only a summer resident, the northward migration starting in Florida about the 1st of May. It is rather a late breeder. Even on the Gulf coast egg laying does not begin until the last of May, and farther north it is two or three weeks later.

Nesting.—The only breeding colony of this species that I have ever seen was on Grand Cochere Island, in the Breton Island reservation. This was a low, flat sandy island, hardly more than a sand bar, 114 miles offshore, south of Pass Christian, Mississippi. I have given a fuller description of it under the royal tern. When I visited this island on June 18 and 19, 1910, I estimated that its bird population consisted of about 7,000 royal terns, 2,000 Cabot's terns, 600 black skimmers, 80 Caspian terns, and 20 laughing gulls. These estimates were arrived at by counting the nests in a measured area and then roughly measuring the total area occupied by the colonies.

There were several small mixed colonies of royal and Cabot's terns, but the bulk of the population was concentrated in one vast colony of approximately 3,500 nests. In this and in the smaller colonies the Cabot's terns were grouped together in certain sections by themselves, though not in any way separated from the general continuity of the colony; but their nests were seldom, if ever, scattered singly among the royal terns. The nests of both species were evenly spread out over a level, sandy plain, above the ordinary high-tide mark, in the central portion of the island, which was entirely devoid of vegetation—a hot, dry waste of sand. They were apparently placed at measured distances, just far enough apart for each sitting bird to be beyond the reach of its neighbor; probably the distances were actually measured by the birds when the eggs were laid, each bird choosing a spot as close to its neighbor as seemed safe from the jabs of a long, sharp bill. The nests were hardly worthy of the name, for they were never more than slight hollows in the sand, with no attempt at lining whatever, and often the eggs seemed to have been dropped on the smooth, flat sand without even a pretense at a hollow. Nearly all of the nests held one egg each, but a few held two. This colony had been washed off another island earlier in the season and had come here for a second attempt at nesting. Captain Sprinkle told me that both of these terns usually lay two eggs at the first laying and only one at the second. The Cabot's terns in this colony were very tame, even tamer than the royal terns. After they became accustomed to my presence I had no difficulty in photographing them at short range without the use of a blind. I was disappointed to find no young in the colony, which would have given me an opportunity to study their home life even better.

From what I can learn from the writings of others this colony was fairly typical of the species and descriptions of other breeding

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Louisiana. A. M. Bailey.

CABOT'S TERN.

FOR DESCRIPTION SEE PAGE 384.

colonies, all of which seem to be on low sandy islands on the seacoast, would be useless repetitions. On the other side of the Atlantic, however, the nesting habits of the species may differ, as several writers speak of nests among the beach grass and nests lined with dry grass. References to such nesting habits by American writers are probably based on the statements of foreign writers.

Mr. W. E. D. Scott (1888) took some young birds on September 20, 1886, "not quite fully grown, indicating that probably more than one brood is raised, and showing how late in the summer the last broods are hatched out." If this species raises two broods it is a notable exception to the rule among the terns; probably Mr. Scott's birds were hatched out late in the season, because earlier attempts were frustrated by storms or other destructive agencies. Cabot's tern has been said to lay as many as three or four eggs to a set, but I believe that such large numbers are exceedingly rare, on this side of the Atlantic at least. Two eggs seem to be the normal number, with occasionally three. One egg to a nest is the rule on second and subsequent layings.

Mr. Stanley C. Arthur writes me regarding his observations on this species:

> There was very little opportunity given me at this time to study the Cabot tern and its young, as what little ones were there were absolutely in the downy stage and evidently too young to eat, for at no time did I see a young Cabot being fed by its parent. I did, however, see the male (?) bringing the female (?) fish food while she was engaged in incubating a single speckled egg which she covered. Here I had an excellent opportunity to learn that the Cabot tern incubated but one egg. While it is true that in one or two instances there were two eggs, so close to make it appear they belonged to a single clutch, yet when the mother bird settled on them she threw her breast feathers over one egg, to the other paying not the slightest concern. In fact, at one time I saw a Cabot tern cover a single egg and with her bill roll the other some inches away from the hollow in which she had deposited her own.
>
> At this time I made an experiment, contemplated for the past several years. I had often wondered why it is, where there are several thousand single speckled eggs, such as the Cabot terns deposit on the beaches, one particular egg can be singled out by the parent as her own private and individual property, and have often wondered whether or not they can, with certainty, know their own egg. I have often been asked: "How does the tern know its own eggs?" and have always facetiously answered: "By counting the spots." As I was studying the birds I selected two Cabots, one on the left and the other on my right, that were marked quite distinctly—one having a wholly black crest and one having its crest speckled with a few white feathers which heralded the coming of the winter plumage.
>
> At 11.15 I left the blind, which naturally scared off the birds, and changed the egg on my left, which had been covered by the pure black-headed tern, and moved it several feet away, exchanging it for the egg that had been covered by the Cabot with white feathers in its crest. This egg was placed on the spot belonging to the black-headed tern. At 11.18 the circling and frantically crying birds commenced resettling on their eggs, and showing not

> the slightest concern each tern sought its own egg despite the fact that it had been moved several feet and placed in a different nest. After allowing each bird to remain on its egg for 15 minutes, I again left the blind and retransferred the eggs with the same result as before. Each parent bird settled on its own egg without hesitation, and, as before, not evidencing any surprise over the change of the location.

The eggs of Cabot's tern are certainly beautiful and subject to great variation; they make one of the prettiest series in the egg collector's cabinet. The ground color on the prettiest eggs varies from "seashell pink" to "pale cinnamon pink," or from "pale pinkish buff" to "pale ochraceous buff." Some show various olive shades, from "olive buff" to "light buff;" others vary from creamy white to pure dull white. The markings vary endlessly in size, shape, and extent. Some eggs are uniformly covered with small spots, densely or sparingly; others are boldly marked with large heavy blotches or irregular, fantastic scrawls. These markings may be confluent in a ring at either end. The markings are usually in the darkest shades of "blackish brown" or black; occasionally they are more or less washed out on the edges, as in the royal tern's eggs; occasionally blotches or scrawls of "burnt umber" or "russet" are overlaid with darker shades; spots, blotches, and scrawls of "pale lavender gray" are seen under the bolder markings. Often both fine spots and bold scrawls are seen on the same egg. When these include two shades of brown and the lavender gray on a pink background the effect is beautiful. One odd egg in my collection has the pink ground color nearly concealed by fine scrawls of several shades of reddish brown, suggesting certain types of falcon's eggs. The shell is smooth, but without luster. The shape varies from ovate to elongate ovate. The measurements of 41 eggs, in the United States National Museum and the writer's collections, average 51.1 by 36 millimeters; the eggs showing the four extremes measure **57** by 37.5, 51.5 by **38.5** and **46** by **33** millimeters.

Young.—Incubation seems to be shared by both sexes and lasts for about three weeks. Morris (1903) quotes Selby as saying:

> As soon as the young birds become tolerably fledged, but before they are altogether able to fly, they frequently take to the water, swimming off to the smaller rocks, where they continue to be fed by the parents until capable of joining them in their fishing excursions.

Plumages.—Downy young Cabot's terns do not show so much variation as young royal terns and will average much lighter in color. They are seldom much darker than "cartridge buff" on the upper parts and are usually buffy white or white. They are also usually immaculate; often a few small dusky tips are seen on the down of the back, and occasionally an individual is uniformly mot-

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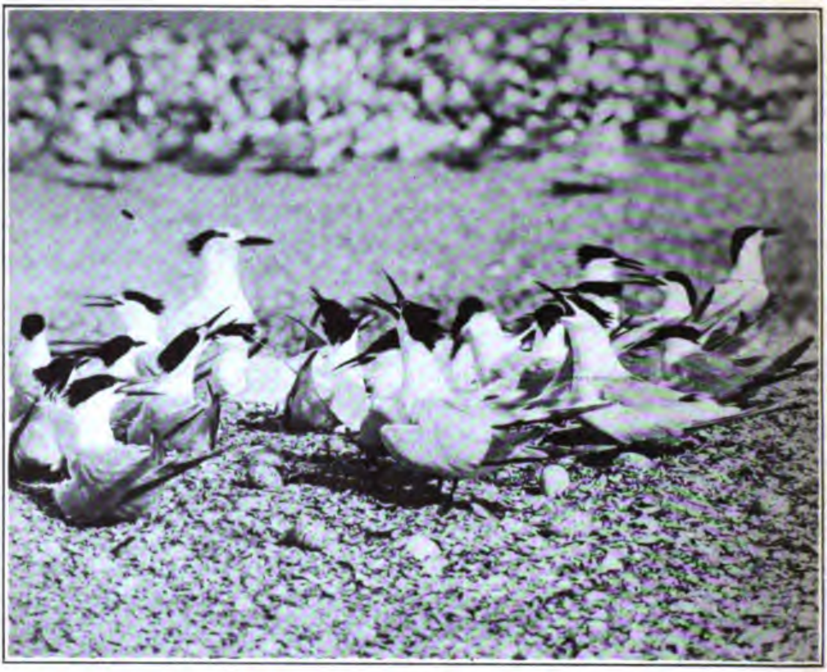
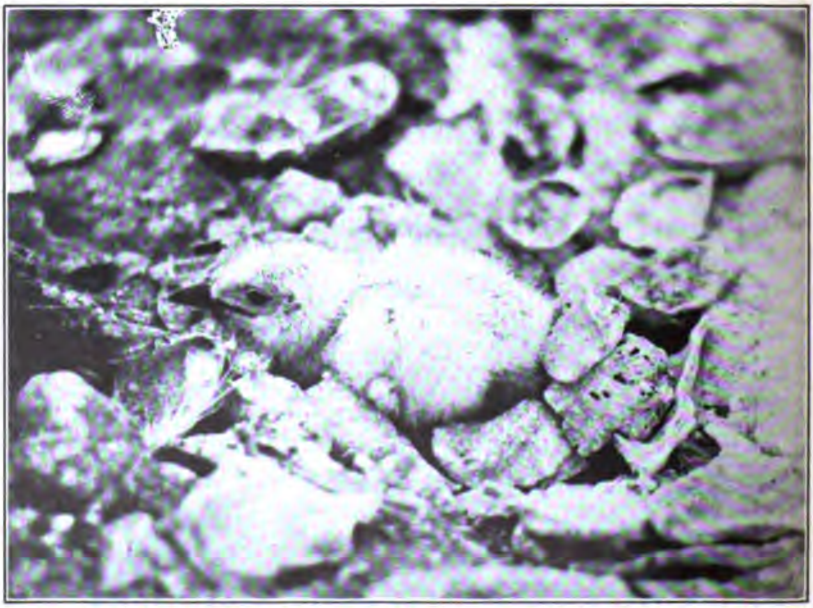


Southwest Key, Louisiana. H. K. Job.



Louisiana. S. C. Arthur.

CABOT'S TERN.

FOR DESCRIPTION SEE PAGE 334.

tled with such dusky tips over the entire back and pileum. The bill is light yellowish flesh-color, and the feet either the same or dull grayish in the dried skin. The juvenal plumage appears first on the scapulars, back, and wings. In the juvenal plumage the forehead and crown are white, the latter streaked with black, which increases on the occiput and auriculars to nearly solid black; the back and scapulars are boldly marked with black spots and V-shaped markings, which are largest and most prominent on the scapulars; the remiges are slaty gray with white edges; the rectrices are grayish white with dusky subterminal areas or black-spotted near the tips; there is a grayish cubital band on the lesser wing-coverts and the greater coverts are washed with pale gray; the under parts are white. A partial postjuvenal molt begins in September, at which the dark markings disappear and the first winter plumage is assumed. This is similar to the adult winter plumage except that the wings and tail of the juvenal plumage are retained. This plumage is worn all winter until the first complete prenuptial molt in the early spring, at which probably most young birds assume a plumage practically indistinguishable from the adult.

Adults have two complete molts each year. The prenuptial molt occurs between March and May, producing the well-known breeding plumage. The postnuptial begins early in July and often lasts through August and September. In winter adults the yellow tip of the bill is duller and more restricted; the forehead is white, the crown narrowly streaked with black, and the occipital crest is brownish black; the tail is shorter than in the spring and shows some gray near the end.

Food.—The food of Cabot's tern consists almost wholly of small fish, such as small mullets, sand launces, and young garfish, which it obtains by making vigorous plunges into the water much after the manner of other terns; but it also eats shrimps and squids. It is more of a sea bird than the smaller terns, and is more often seen feeding out on the open sea or among the breakers than in the quiet tidal estuaries. Audubon (1840) thus describes its feeding habits:

> While plunging after the small mullets and other diminutive fishes that form the principal part of its food, it darts perpendicularly downward with all the agility and force of the common and arctic terns, nearly immersing its whole body at times, but rising instantly after, and quickly regaining a position from which it can advantageously descend anew. Should the fish disappear as the bird is descending the latter instantly recovers itself without plunging into the water.

Behavior.—In flight this is one of the swiftest and most skillful of the terns. Its long, slender, pointed form is highly specialized for speed and ease in cutting the air. Mr. Montague Chamberlain (1891) says:

> Its strength of wing and skill enable it to outride the severest storms, and flocks of these birds may be seen dipping into crested waves or skimming over angry breakers to seize the prey that may be brought to the surface by the gale.

Intermediate in size between the two large terns and the several smaller species, it seems to combine the strength and vigor of the former with the activity of the latter. It may be distinguished from either by its shape and by its long, slender bill. The yellow tip of its bill is quite conspicuous at short range.

Its cry is short, sharp, loud, and shrill. Audubon (1840) refers to it as "sharp, grating, and loud enough to be heard at the distance of half a mile." Morris (1903) calls it "a loud, hoarse, and grating cry or scream, likened to the syllables 'pink' or 'cree.'" Yarrell (1871) noted the syllables "kirhitt, kirhitt." When disturbed on its breeding grounds, or when feeding in flocks, it is very noisy.

Winter.—Throughout the southern portions of its breeding range in this country, on the southern Florida and Gulf coasts, Cabot's tern is a permanent resident, its numbers being increased by the addition of migrants from more northern points. The species withdraws in the fall from its summer resorts, on the coast of Virginia, the Carolinas, and northern Florida, to its winter home in the Bahamas, the Gulf of Mexico, and the coasts of Central and South America. Here it spends the winter roaming about the outer islands and sand bars in company with other terns and gulls, following schools of fish or resting in flocks on the sand. At this season it is highly gregarious and quite shy.

DISTRIBUTION.

Breeding range.—Atlantic and Gulf coasts from Virginia (Northampton County) to British Honduras (Saddle Cay). Some of the Bahamas (Acklin and Ragged Islands, Samana Keys, etc.), and West Indies (from Cuba to Dominica).

Winter range.—From the Bahamas and Florida southward through the West Indies and along the Atlantic coast of South America to southern Brazil (Iguape). From the coasts of Louisiana and Texas southward, along the Central American coast to Colombia (Cartagena). And on the Pacific coasts of Oaxaca (San Mateo) and Guatemala (Chiapam).

Spring migration.—Birds depart from coast of Brazil during March and April and first arrivals reach South Carolina, Capers Island, April 9.

Fall migration.—Apparently in September, but data is very scanty.

Casual records.—Stragglers have wandered in summer as far north as Massachusetts (Chatham, August, 1865). Three specimens taken in spring of 1882 in Lucknow, Ontario. A few remain in Brazil in summer (Iguape, June, and Rio Janeiro, August).

Egg dates.—Texas: Eighteen records, April 25 to June 14; nine records, May 17 to 28. Bahamas: Twelve records, May 14 to June 20; six records, May 16 to 22.

STERNA TRUDEAUI Audubon.

TRUDEAU'S TERN.

HABITS.

This unique and well-marked species belongs to the South American fauna and is a very rare straggler to North America. The only record for North America is that of Audubon (1840), who first described the species and says of it:

> This beautiful tern, which has not hitherto been described, was procured at Great Egg Harbor, in New Jersey, by my much esteemed and talented friend, J. Trudeau, Esq., of Louisiana, to whom I have great pleasure in dedicating it. Nothing is known as to its range, or even the particular habits in which it may differ from other species. The individual obtained was in company of a few others of the same kind. I have received from Mr. Trudeau an intimation of the occurrence of several individuals on Long Island.

Nesting.—Mr. A. H. Holland (1890) has studied Trudeau's tern in its native haunts in Argentina in the region of Estancia Espartilla. He says:

> This tern is rare with us, excepting in the breeding season, when it appears suddenly and in numbers, either single or in pairs.
>
> While hunting through a large gullery of *Larus maculipennis* early in November I came upon a corner of the lagoon entirely occupied by these pretty terns. There was little shelter for the nests, a few scattered willow stumps, but no rushes or flags, and the water was some 4½ feet deep. The nests were all placed together, as the gulls' nests were, 30 or 40 of them, each a foot or two from its neighbor, and so on. They were very shallow structures, composed of green water grasses (very succulent ones and wet), with no lining, and supported on the water by the thick growth of grass underneath. The eggs were three to four in number, of the usual tern type, varying from the dark, thickly spotted, and blotched varieties to the thinly spotted pale ones. In no two nests were the eggs similar. As I approached the ternery (if there is such an expression) the birds became very anxious, darting down close to my head as I stood over a nest and uttering shrill cries. The sight was a beautiful one, with thousands of gulls and these graceful terns as well, all showing beautifully against a blue sky.

Eggs.—There are three sets of eggs of this rare species in the collection of Col. John E. Thayer, which were collected by Mr. Herbert Ozan on St. Ambrose Island, in the St. Felix group, off the coast of Chile, on December 17, 1907. The nests were mere hollows scraped in the sand among bowlders without any material of any kind or any lining in the nests. The "birds were close sitters, perching on rocks only 10 feet away while the eggs were secured. The male bird was killed by a stone thrown by a companion," according to the collector's notes. There are seven eggs in the series—one set of three and two sets of two. The eggs are not distinguishable from certain types of common tern's eggs. The ground color varies from "Isabella color" to "deep olive buff." Some are uniformly spotted or blotched with dark browns, and some are more heavily blotched at the larger end. One set is spotted with the lighter shades of brown and olive. Some of the eggs show underlying spots of drab or lilac. The shape is ovate. The measurements of these eggs and of three furnished by Rev. F. C. R. Jourdain, 10 in all, average 41.7 by 30.6 millimeters; the eggs showing the four extremes measure **46.4** by 30.4, **44.7** by **31**, **39** by 30.5, and 39.5 by **30** millimeters.

Plumages.—Nothing seems to be known about the downy young or the immature plumages. The full nuptial plumage is well illustrated in Audubon's plate. Two birds in my collection taken in Argentina on October 17 and 27 are just completing the molt of the primaries, but otherwise are in full fresh winter plumage; probably they are young birds, for adults should be molting into the nuptial plumage at this time. Dr. L. C. Sanford, from whom I obtained my specimens, has quite a series in this plumage collected by Mr. R. H. Beck in the same locality at about the same time, but there are no adults in nuptial plumage among them. The winter plumage is strikingly like that of Forster's tern, but Trudeau's tern may be distinguished by the much shorter and much less deeply forked tail, the long streamers of the outer rectrices being very conspicuous in the Forster's tern. The bill in Trudeau's tern, especially in adults, is also longer and slenderer than in the commoner species, and it is tipped with yellow.

Behavior.—As to the habits, behavior, and life history of Trudeau's tern there is nothing more to be said at present.

DISTRIBUTION.

Breeding range.—Known to breed only in Argentina (Estancia Espartilla, Ajó district, etc.) and off the coast of Chile (St. Ambrose Island).

Winter range.—Unknown.

Migrations.—Not definitely known. Argentina records: Estancia Espartilla, September to February; La Plata River, March; Mar del Plata, October 17 to 27; Punta Lara, October; Buenos Aires, September, November, and January. Brazil records: Rio Janeiro, August; Santa Catharina, February and August. Straits of Magellan, Punta Arenas, November 19 and 20. Chile, Arica Bay, August.

Casual record.—Accidental in North America. New Jersey (Great Egg Harbor).

Egg dates.—St. Ambrose Island, Chile: One record, December 17.

STERNA FORSTERI Nuttall.

FORSTER'S TERN.

HABITS.

Although differing from the common tern in several details and in its habits, the Forster's tern so closely resembles it in general appearance that it is not to be wondered at that the species remained so long unrecognized, and that, even after its discovery, its distribution and habits were so little understood. Audubon (1840) described and figured this species, in its winter plumage under the name *Sterna havelli*, but apparently never recognized it in its spring plumage. Doctor Coues (1877) says of it:

> Swainson and Richardson described it as the common tern; Wilson did not know it at all; and Audubon only became aware of it in the imperfect plumage which he described as "*havelli.*" Nuttall doubtingly gave it a name upon the strength of Richardson's description. Mr. Lawrence, in 1858, was the first to elucidate its characters satisfactorily, while it was not until the appearance of my paper that its changes of plumage became known.

But even he, with all his wide field experience, was entirely ignorant of its breeding range, saying:

> It breeds in the interior of British America, and very abundantly, to judge from the great numbers of eggs from that region I have seen. It may yet be found to nest on or near the northern tier of States.

It is now known, of course, to have a very wide breeding range, as far east as Virginia, as far south as Texas, and as far west as California.

It seems to me that the name marsh tern might much more properly have been applied to this species than to the gull-billed tern, for Forster's tern is, during the breeding season at least, essentially a bird of the marshes, whereas the gull-billed tern shows a decided preference for sandy beaches.

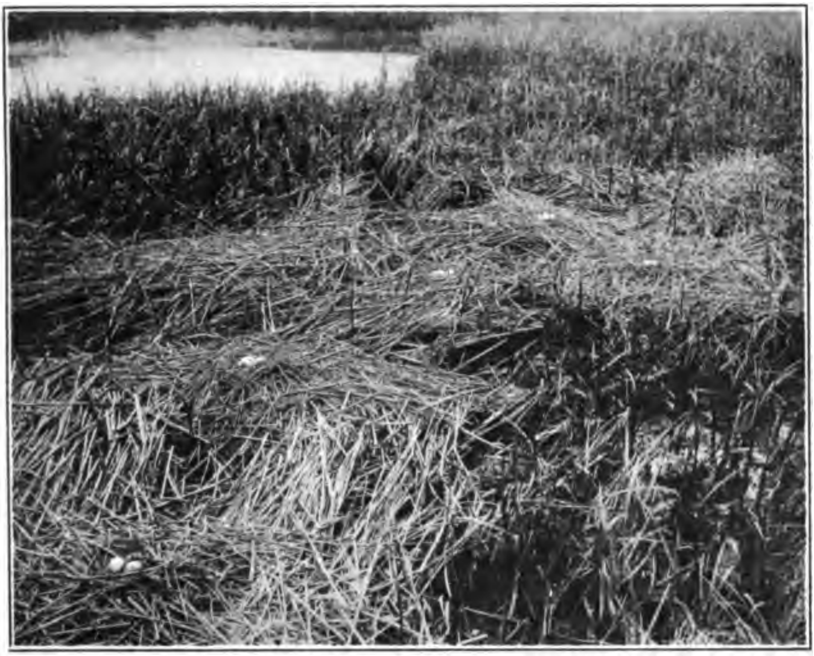
Spring.—Rev. P. B. Peabody (1896) says that these terns arrive on their breeding grounds at Heron Lake, Minnesota "about April 7," and describes their behavior as follows:

> Terns creep, scout-like, on the wing, along the thawing shores. Then, as heat and wind wave melt and crush the ice bonds of the lake, the tern speedily assumes the hawk-like (or swallow-like) habit, wandering fitfully over the newly released waters, with eye alert, beak pointing downward, and with many a

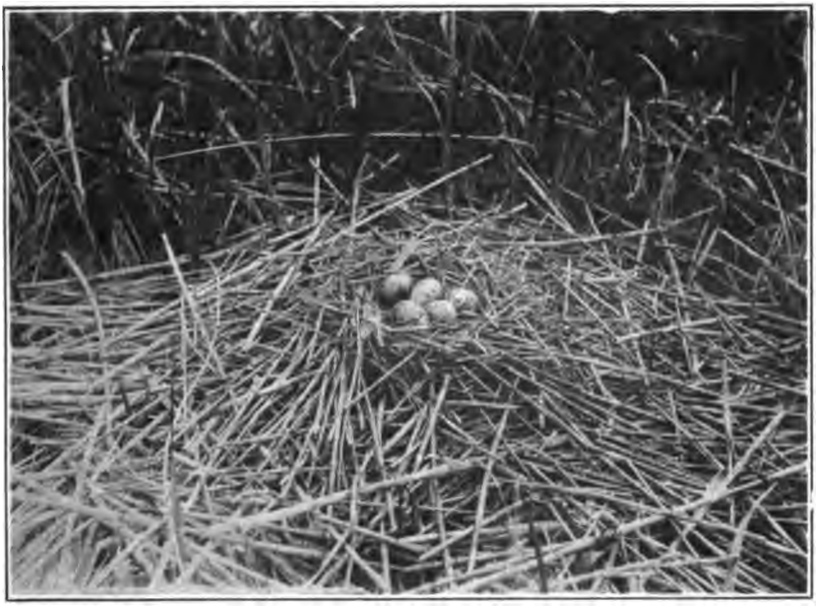
shrill but cheery cry of self-gratification or of brotherly good will. He knows not fear. As one rows among the innumerable "copes" of rush and flag, bent on reaching the Mallard's feeding ground, a skirmish line of terns will wander by, 20, 15, 10 feet overhead, furiously, without swerving a wing breadth from their course. The one or two that are passing eye curiously the dumb decoys in the boat's belly, and then saunter on with a rattling "jeer" of derision at the hunter who toils at the oar, and who, unlike the tern, is never quite sure of his game. But, then, our black-capped jaeger hunts all day.

Nesting.—I first found this species breeding on Wreck Island, off the coast of Virginia, on June 28, 1907, where we discovered a colony of about 50 pairs. This and the other large islands in the group are much like Cobb's Island, consisting of long, wide beaches on the outer, or ocean, side, flat and sandy in some places or piled high with accumulated oyster shells in others. Back of the beaches, on the shore side, are extensive salt meadows or marshes, intersected by numerous creeks and dotted with small ponds or mud holes. On the outer beaches we found breeding colonies of black skimmers, common and gull-billed terns, and over the marshes were scattered nests of laughing gulls and clapper rails. Our attention was first attracted to the Forster's terns by their harsh grating cries, as they flew out to meet us while exploring one of the creeks in our skiff. We finally located the colony, by the actions of the birds, just beyond the long grass, which grew thickly along the banks of the creek, and found the nests thickly scattered along the drifted piles of dead sedges, which the high tides had floated off the marsh and deposited in long rows close to the tall-growing sedges. The nests were so close together that I counted 12 nests in a space about 10 yards long by 3 yards wide. One nest was placed within 3 feet of a clapper rail's nest. The nests were mostly large and elaborate structures, remarkably well built, and reminding me of the nests of Franklin's gulls. They consisted of large piles of dead sedges and grasses, surmounted by neat little nests, deeply hollowed, with well-rounded and compactly woven rims. They usually measured between 20 and 30 inches in diameter, the smallest one measured being 16 inches at the base; the cup-shaped portion, or nest proper, measured from 7 to 8 inches outside and from 4 to 5 inches inside in diameter; the inner cavity was from 1 to 1½ inches deep and was neatly lined with split reeds and grasses. On the whole, the nests looked like works of art when compared with the slovenly nests built by other species of terns. Most of the nests contained three or four eggs, but many sets of five were found and a few nests held newly hatched young.

In the Breton Island reservation, off the coast of Louisiana, I found two breeding colonies of Forster's terns. On Battledore Island a colony of about 30 pairs were nesting in a compact group on a strip of drift seaweed which had washed up over a marsh and lodged against the tall grass and "black mangrove" bushes sur-



Wreck Island, Virginia. A. C. Bent.



Wreck Island, Virginia. A. C. Bent.

FORSTER'S TERN.

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rounding it. Numerous Louisiana herons were nesting in the "mangroves" and vast colonies of breeding, laughing gulls and black skimmers occupied the remainder of the island. The terns' nests were similar to those seen on the Virginia coast, described above, and the eggs were nearly all hatched. The following day (June 22, 1910) I found a much larger colony of this species, consisting of about a thousand pairs, on Hog Island, a few miles distant. This island had been broken up into several sections by the washing away of beaches and soil, leaving large areas of swampy salt meadows, overgrown with long grass and extensive thickets of "black mangrove" bushes. Louisiana herons were breeding in the "mangroves" and laughing gulls and Forster's terns on the marshes. Most of the tern's eggs had hatched and some of the young were nearly grown.

In Texas the nesting habits of this species seem to be entirely different. Mr. George B. Sennett (1878) on May 16 found it breeding in the salt marshes on the Rio Grande.

> On the same low and nearly submerged island where we found the eggs of stilt, *Himantopus nigricollis*, and some hundred yards or more distant, was a group of these terns upon the ground near their eggs. When we approached them they commenced screaming and flying about in great distress. They had only fairly begun to lay, as no set was complete. One or two eggs were all that any nest contained, and some were not occupied. The nests were situated farther away from the water than the stilts, but still where the mud was wet, and consisted simply of a patting-down of grasses and soil into a shallow, saucer-shaped depression.

Mr. N. S. Goss (1891) found them "breeding in numbers on the small islands in Nueces Bay, Texas, as early as the 1st of April. The birds at such times are very noisy, and, as their nesting places are approached, their hoarse notes as they circle close overhead are almost deafening. Nest, a hollow, worked out in the sand, and broken shells, and lined with grasses."

Still another style of nesting seems to prevail in the western States. Mr. Robert B. Rockwell (1911) gives an interesting account of a colony of Forster's terns in the Barr Lake region of Colorado, saying:

> On May 24, 1907, a week after the first eggs were found, the breeding colony was in full swing, and we were surprised to find a number of nests containing complete sets, which had been built by the birds upon floating masses of decaying cat-tails. These structures were all made entirely of dead cat-tail stalks, and while they varied greatly in size and bulk, the general plan of construction was the same in all, being a compact pile of material of irregular outline, apparently floating on the surface of the water (although in reality the nests were supported by masses of dead cat-tails beneath the surface of the water), and were very conspicuous owing to the lack of concealing vegetation. The eggs were deposited in the center of the pile in a neat depression, which was lined with small bits of the same material. The bottom of the cavity was, in every instance, well above the surface of the water (usually from 2 to

> 6 inches), and the nest cavities were entirely free from moisture. Most of these nests were built in comparatively open water almost waist deep, and about 30 yards from shore. On the date mentioned (May 24) 15 nests were examined, about a third of which were constructed by the birds as described, while the remaining two-thirds were the usual depressions in muskrat houses. The majority of these nests contained three eggs, but a few of them held only one and two, and one nest contained five.

The habit of nesting on old and partially dilapidated muskrat houses seems to be common at many places throughout the lakes and swamps of the interior. In such situations little, if any, nest is built, and sometimes two, or even three, sets of eggs are found on one house. Usually the nest consists merely of a hollow excavated in the half-decayed vegetable rubbish, but sometimes a few reeds, rushes, or bits of grass, brought from a distance, are added to line the cavity or build up a slight rim around it.

Mr. Milton S. Ray (1903) describes a breeding colony of this species in Lake Valley, California, in which—

> the nests were built in various situations. The majority were built up of dry tules where the water is about 5 feet deep. When freshly built of green tules the nest formed a pretty picture. They were placed among tall, thick tules or marsh grass and pond lilies at their edge. Great difference existed in the nests, some being elaborate structures, while others were scantily made and placed on soggy masses of dead tules or floating logs.

In Washington, according to Dawson (1909), these terns make use of the old nests of the western grebe and sometimes even appropriate an occupied nest of the latter. He shows a photograph of such an occupied nest, and says he has "seen others in which the eggs of the rightful owner were nearly buried under a little turret of dried reeds, upon which the tern had been allowed to place her full complement of eggs."

Eggs.—In spite of the fact that the breeding season is much prolonged, and that early and late sets of eggs are often found, the Forster's tern doubtless raises only one brood in a season. The normal set consists of three eggs, sometimes only two; sets of four eggs are common, sets of five are not rare, and even sets of six have been reported. These larger sets usually, if not always, show evidences of having been laid by more than one female, either in the shape, color, or extent of incubation in the eggs.

The eggs of Forster's tern are practically indistinguishable from those of the common tern. In shape they are ovate, short ovate, or elongate ovate. The shell is thin, smooth, and without luster. The ground color varies from 'tawny olive" or "cinnamon buff" to "cartridge buff" or "pale olive buff." The markings are usually rather small spots, more or less evenly distributed, but often these are congregated to form a ring on or near the larger end; many eggs are boldly and handsomely marked with large blotches or ir-

Barr Lake, Colorado. R. B. Rockwell.

Barr Lake, Colorado. R. B. Rockwell.

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regular scrawls. These markings are in the darker shades of brown, such as "chestnut brown," "burnt umber," or "seal brown." Some eggs have underlying blotches of lighter shades, such as "tawny russet" or "hazel." Nearly all eggs, especially the lighter types, show spots or blotches of various shades of lilac or lavender grays. Where there are markings of several different colors on the same egg the effect is often very pretty. The measurements of 65 eggs, in the United States National Museum, average 43 by 31 millimeters; the eggs showing the four extremes measure 48 by 29.5, 43 by 32.5, 39 by 31 and 42 by 28.5 millimeters.

Young.—The period of incubation is 23 days, and probably both sexes incubate. The young remain in the nest for a few days, until they are strong enough to run about or swim, when they become very lively and pugnacious. They take to the water readily and soon become expert at running or swimming about the marsh and hiding in the grass. They are fed by their devoted parents until fully grown and able to fly.

Plumage.—The downy young is quite different from that of the common tern. The upper parts vary from light "clay color," through "cinnamon buff" to "pinkish buff," shading off to paler shades of the same color below, paling on the breast and belly almost to white, and darkest on the throat, which is "wood brown" or "drab" in some specimens, but never so dark as in the common tern. The upper parts are heavily spotted or streaked with black or "blackish brown," less heavily on the head and more heavily on the back, where these markings are confluent into great blotches or longitudinal bands. This color pattern is well adapted to conceal the chick among the lights and shadows of the marsh grass where it hides.

The juvenal plumage, which is acquired by the time that the young bird has attained its growth, is also quite distinctive and matches the surroundings in which the young bird lives with a heavy suffusion of dark browns on the upper parts. In this plumage the pearl gray of the back and scapulars is almost wholly concealed by the brown terminal portions of the feathers, which are "clay color" or "cinnamon buff," centrally clouded or barred with "snuff brown," or "burnt umber"; the top of the head is nearly uniform "snuff brown"; the sides of the neck are heavily clouded, and the forebreast and rump are lightly clouded with the same color, which also shows on the tips of the lesser wing-coverts, some of the greater wing-coverts, and the rectrices; a conspicuous black patch surrounds the eyes and covers the auriculars. As the season advances all these brown markings fade or wear off to produce the first winter plumage; in this plumage the rump and breast become pure white, the browns on the upper parts gradually disappear or leave only traces of the buffy edgings in the shape of transverse bars; a partial molt of the body plumage also takes place at this time. Young birds, in their first winter plumage, may be distinguished from adults by their shorter and less deeply forked tails with some brownish mottling and by their darker primaries, which are less silvery and have t white spaces more sharply contrasted with the black.

A complete prenuptial molt in February and March produces the first nuptial plumage, which is usually indistinguishable from the adult. Some young birds in nuptial plumage have wings somewhat like those of the first winter plumage; others renew the first winter plumage of the head; but, as a rule, young birds become indistinguishable from adults when 9 or 10 months old.

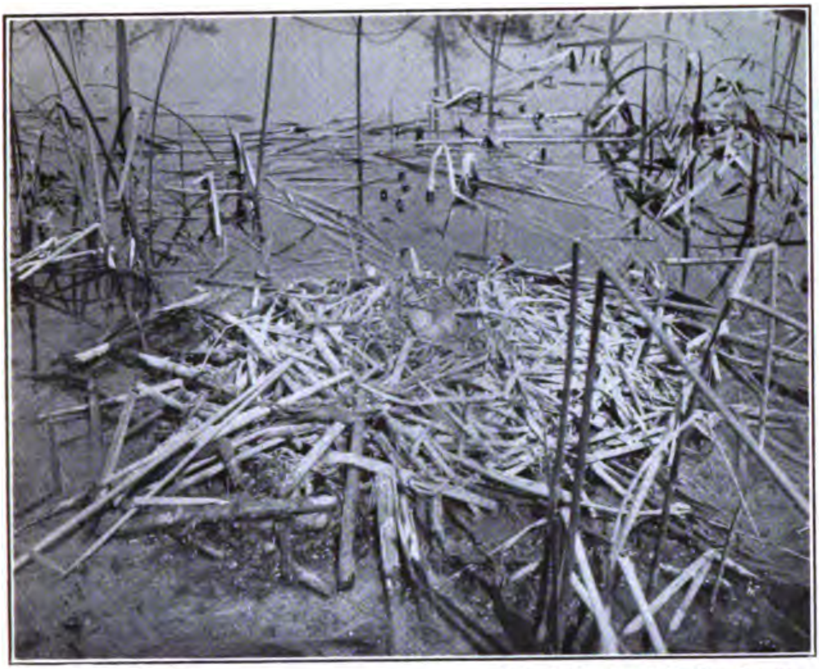
Adults have two complete molts—a prenuptial in February and March and a postnuptial in August—and two distinct plumages. The adult winter plumage, which Audubon described as *Sterna havelli*, is quite different from the well-known spring plumage. The crown is usually largely and sometimes wholly white, though dusky spots are often scattered through it, and there is a more or less distinct nuchal crescent of dusky tipped feathers; there is a distinct black space, including the eye and the ear coverts; the lateral tail feathers are shorter than in the spring, and the primaries, when freshly grown, are beautifully silvered.

Food.—Being so largely a bird of the marshes, Forster's tern feeds less on fish and has a more varied bill of fare than the other terns. It may be seen catching insects on the wing, as well as hovering over the pools, its bill pointing straight downward, looking for tiny morsels of food on the surface. It sometimes makes a diving plunge into the water, but more often it drops down lightly or swoops gracefully along the surface, picking up its food without wetting its plumage. Rev. P. B. Peabody (1896) notes that "the first apparent spring-time food consists of dead fish and frogs and other *aquatica* that have perished in the winter ice, and are being revealed as the latter melts beneath the sun." Mr. W. L. Dawson (1909) says:

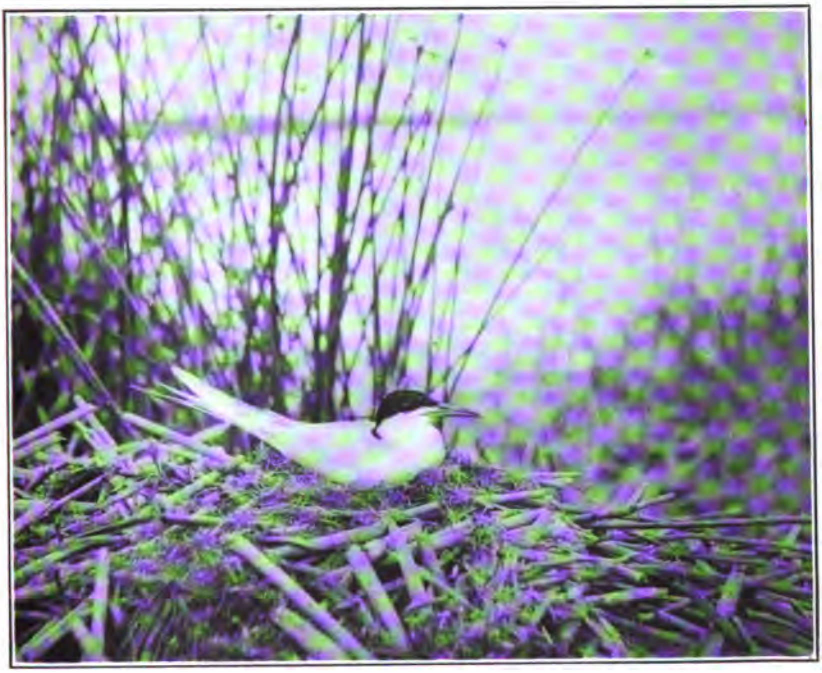
> When the insects are flying well the terns prefer to hawk. Dragon flies and caddis flies are favorite quarry, and in pursuit of the latter the birds will often rise to a height of several hundred feet.

The birds shot in Louisiana by Audubon (1840) "were engaged in picking up floating coleopterous insects."

Behavior.—I have never been able to discover anything distinctive in the flight of Forster's tern; it is as light and graceful as that of the common tern, which it closely resembles in every particular. Although quite different in the fall, the two species can not be easily distinguished in the spring; the white breast of the former is often obscured by shadow, the slight difference in size inappreciable, and



Barr Lake, Colorado. Colorado Museum of Natural History.



Malheur Lake, Oregon. W. L. Finley.

FORSTER'S TERN.

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the only field mark of consequence is the slightly longer tail of *forsteri*, which is not very conspicuous.

The voice, however, is quite distinctive and usually makes identification easy and certain. The cry of the young bird in juvenal plumage, as we heard it in the Manitoba marshes, is a shrill, high-pitched squeal, quite different from the notes of other terns or gulls. I noted at the same time the call of the adult as harsh and grating, on a low key and sounding like "tza-a-ap." Elsewhere in my notes I find that I have described the same note as "zreep" or "zrurrrr"—a rasping, nasal, buzzing sound, suggesting the well-known note of the nighthawk. It also utters on rare occasions a soft "wheat, wheat," like the common tern. On the Virginia coast the prevailing notes were the characteristic, harsh, grating cries described above; but I also heard here a shrill, peeping note, "pip, pip, pip, pip, pip," rapidly given.

Mr. Peabody (1896) condemns Forster's tern as a "mis-avian spirit," saying:

> While sociable among his kind, and, to them, moderately good-tempered (except in the breeding time), he is radically hostile to all other birds. A veritable Ishmael among the waterfowl, his spirit, both of courage and of mean cowardice, is never so clearly portrayed as when, by mutual encroachment upon favorable waters, many species other than those of *his* feather flock together.
>
> Evidently the tern has many foes. The Franklin's gull is his arch enemy; the muskrat and the mink undoubtedly do away with many eggs, while the character of this tern himself inclines me to think that he occasionally plays the cannibal.

Mr. Rockwell (1911) cites the following incident:

> A few black-crowned night herons were nesting among the terns, and one unfortunate youngster, unable to fly, who deserted his nest at our approach, took refuge on a tern's nest, where he was promptly attacked by half a dozen of the birds, and although twice as large as his assailants, was knocked down repeatedly by well-directed blows of the birds' wings, until he finally sought safety in the water.

Winter.—As Forster's tern is somewhat hardier than others of its genus, the fall migration is more prolonged and it winters farther north. Migrants begin to arrive on the Carolina coasts as early as August and linger until late in the fall, wintering regularly in South Carolina and occasionally farther north. In Florida it is a very common winter resident on inland waters and on the coast.

DISTRIBUTION.

Breeding range.—Temperate North America, mainly within the United States, at widely scattered localities. East to western Ontario (Port Maitland, near the east end of Lake Erie) and the coast of

Virginia (Northampton County). South to the coast of Louisiana (various islands), southern coast of Texas (Refugio to Cameron counties), central Colorado (Barr Lake region), northern Utah (Great Salt Lake region) and central California (Merced County). West to the central valleys of California (San Joaquin and Sacramento Valleys), central southern Oregon (Klamath Lakes), and central Washington (Douglas County). North to central Alberta (60 miles southeast of Edmonton), and central Manitoba (Lake Winnipegosis).

Breeding grounds protected in the following national reservations: In Louisiana, Breton Island and Shell Keys; in Oregon, Klamath Lake and Malheur Lake.

Winter range.—From the coast of South Carolina and the Gulf coasts of Florida, Louisiana, and Texas southward to Brazil (Pernambuco. From southern California (San Diego region) southward along the west coast of Mexico to Guatemala.

Spring migration.—Early dates of arrival: Virginia, Smith's Island, May 10; New Jersey, Five Mile Beach, April 26, and Long Beach, May 14; Ohio, Cincinnati, May 4; Ontario, May 22; Kansas, Emporia, April 18; Illinois, Chicago, May 6; Minnesota, Heron Lake, April 7; Manitoba, Oak Point, May 17; California, Stockton, April 17, and Monterey, May 10.

Fall migration.—Early dates of arrival: Lower California, San José del Cabo, September 29; Guatemala, Lake Duenas, October 28. Late dates of departure: Ontario, Toronto, October 19; Minnesota, Heron Lake, October 14; California, Monterey, September 23.

Casual records.—Stragglers in summer and fall have been taken as far east as Massachusetts (Ipswich, September, 1870, and Monomoy Island, October 2, 1880).

Egg dates.—Virginia: Twenty-eight records, May 30 to July 12; fourteen records, June 5 to 28. Manitoba: Twenty-one records, June 7 to July 12; eleven records, June 8 to 21. Utah: Nineteen records, June 5 to July 3; ten records, June 11 to 20. California: Fifteen records, May 26 to July 12; eight records, May 27 to June 15.

STERNA HIRUNDO Linnaeus.

COMMON TERN.

HABITS.

One of the most charming features of our eastern seacoast is this graceful little "sea swallow." The most attractive combination of summer sea, sky, and sandy beach would be but an empty, lifeless scene without the little "mackerel gull," such a fitting accompaniment of its gentle surroundings and so suggestive of summer sunshine and cooling sea breezes. One can not help admiring such an elegant and dainty creature, its spotless and delicate plumage and its buoyant, graceful flight, as it flies listlessly up the beach until the discovery of some school of small fry, on which it feeds, causes it to pause, hover for an instant, and plunge headlong into the water for some tiny minnow.

We came near losing this beautiful bird a few years ago, because its exquisite plumage was so much in demand for feminine decoration that, before we realized it, collectors for the millinery trade had alarmingly reduced its numbers. Stringent laws, however, were passed for its protection and it has now practically regained its former abundance. The most important breeding colony in Massachusetts is on Muskeget Island, between Nantucket and Marthas Vineyard, which has been rigidly protected for a number of years and contains the largest sea-bird colonies on the New England coast south of Maine. Mr. George H. Mackay kept very close watch over it during its most critical period, and the keeper of the life-saving station has guarded it ever since. That the terns prospered under protection is clearly shown by Mr. Mackay's records, covering a period of five years from 1894 to 1898, inclusive, during which time they nearly doubled in number.

When Mr. William Brewster first visited Muskeget in 1870 the terns were astonishingly abundant though he was told by the fishermen that they had been diminishing for years. Four years later he found their numbers sadly depleted by the depredations of fishermen who landed there regularly to collect their eggs, through June, July, and August, keeping the poor terns laying like hens, so that very few of them succeeded in raising broods. I made five visits to Muskeget in 1885, 1889, 1890, 1892, and 1903. Between my first two visits they continued to decrease in spite of the new laws enacted for their protection, but between 1890 and 1902 they increased again and are now probably as abundant as they ever were within my memory. Mr. Mackay's record show a very satisfactory increase between 1894 and 1898. Egging operations and shooting for millinery purposes have been effectively stopped.

Muskeget Island is the largest of a group of small, low sandy islands forming a part of the southern boundary of Nantucket Sound. It is a little more than an elevated sand bar raised above the level of the numerous sand shoals so dreaded by sailors in that region, which are usually invisible at high tide, but in rough weather are white with combing breakers. A life-saving station has been established there for the rescue of unfortunate mariners. A few fishermen's and gunners' shanties are the only other buildings on the island. It is approximately crescent shaped, though its outline changes frequently, and is about 3 miles long and a mile wide. Several small islands near it are practically a part of it. In the central portion of the island are low rolling sand hills and small sand dunes; the beaches are mostly flat and sandy, though in some places stony. Vegetation is scarce over most of the island, consisting of a sparse growth of beach grass (*Ammophila arundinaca*) and a low-growing poison ivy (*Rhus radicans*), with scattering patches, some of them quite extensive, of bayberry (*Myrica carolinensis*) and beach plum (*Prunus maritima*) bushes. In some places the beach grass grows tall and thick or in dense clumps or tufts. The isolation of this island, the variety of nesting sites offered, and the abundant food supply to be obtained in the adjacent shoals and tide rips make Muskeget an ideal breeding ground for common and roseate terns and laughing gulls. I know of no more extensive or interesting colony of these two terns on the American coast. A visit to Muskeget Island in June or July, the height of the breeding season, is an experience never to be forgotten. As we approach it in our little sailboat a cloud of minute white specks is seen hovering over it and the air is full of birds coming and going, for not all of this vast multitude can find food enough in the immediate vicinity; hence they wander far to the shores of Martha's Vineyard and Cape Cod.

As we land and walk out among the sand hills the terns rise from the ground on all sides and circle about us overhead in an ever-increasing cloud. Some are darting down at our heads with harsh and grating cries of protest, others are drifting around us closely at hand. If we look up into the air we are made fairly dizzy; for as far as we can see, extending up into the deep blue sky, is a bewildering maze of whirling birds, flying in every direction and at varying heights in countless thousands. Their plaintive notes when heard singly are nearly musical, but the combined din of such a multitude of voices is almost deafening in its effect, and for days afterwards we can hear the rhythmic chorus ringing in our ears. If we shoot down one of them every voice is hushed; the silence is appalling as they come gliding in from every side in sympathetic horror to hover over their fallen companion and try to encourage him to rise again. Some observers have attributed this action to another motive—the desire to kill and remove a useless member of their society—but I have never seen any evidence to support this theory. Now is the greedy murderer's chance, as the plume hunters have learned to their advantage, for as fast as the terns are shot down others will hurry in, and, as if at a given signal, all will burst out again into an excited chorus of angry cries of protest, hovering over and darting down at their dead companions in confusion and despair; but if no more are shot they seem soon to forget, the crowd gradually disperses and all goes on as if nothing had happened. Perhaps a marsh hawk may appear upon the scene quartering over the low ground in search of

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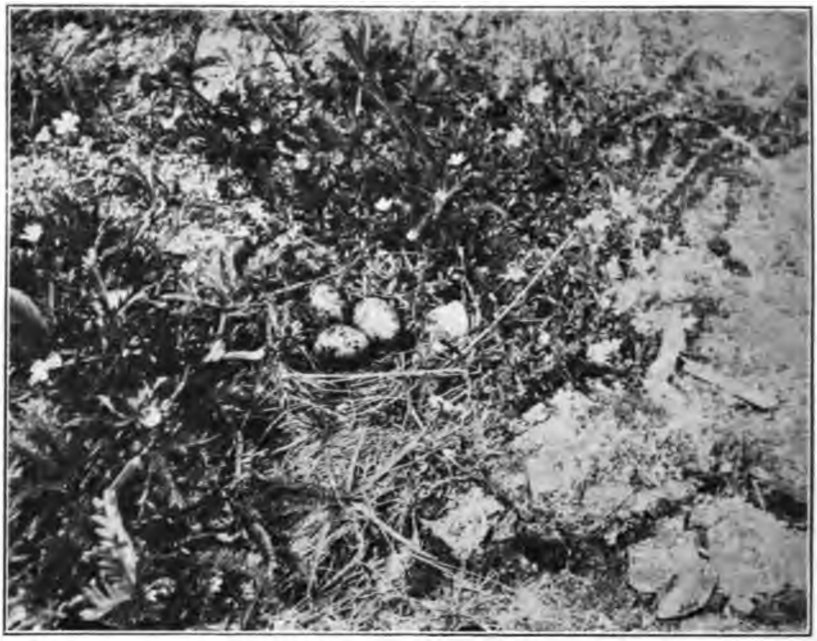
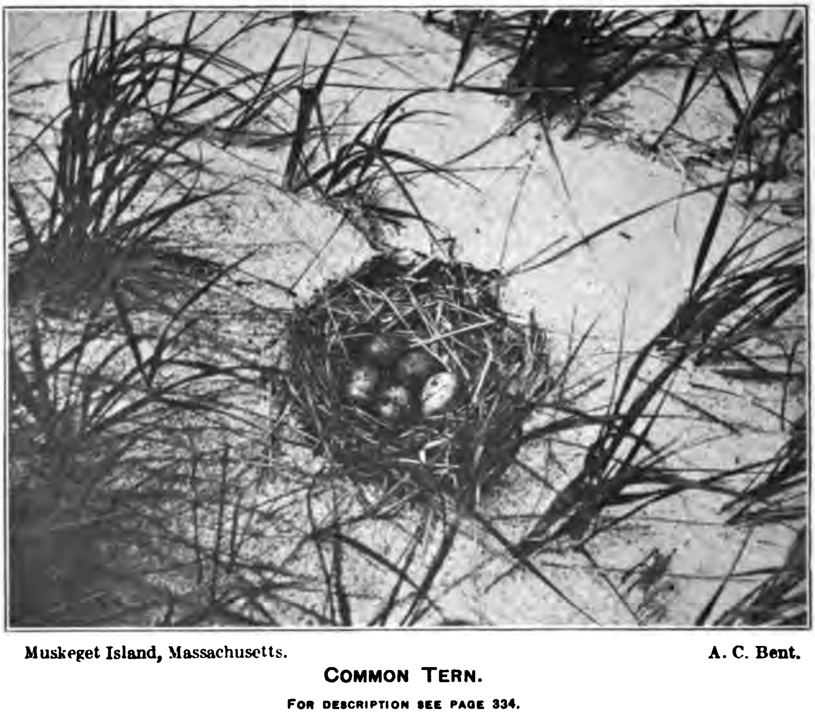


Penobscot Bay, Maine. A. C. Bent.



Muskeget Island, Massachusetts. A. C. Bent.

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mice. The din suddenly ceases, every voice is still; the silence is so striking that we look up to see the cause, as thousands of white wings are diving after him in an angry mob, and he is forced to beat a hasty retreat, leaving the terns free to renew their attacks on us.

Spring.—The terns arrive at Muskeget usually about the 8th or 10th of May, but sometimes as early as the 1st, their time of arrival depending somewhat on the weather conditions prevailing at the time, mild weather with strong southwest wind being favorable for their migration, and cold northerly winds retarding it. When first seen they are usually flying high in the air in small numbers, but they soon settle down onto the island as their numbers increase.

Courtship.—Soon after their arrival they may be seen indulging in their simple courtship performances. Gathered in a small party on the beach, resting and sunning themselves, the male begins strutting about before and around the females. His neck is stretched upwards to its fullest extent with his bill pointing to the sky, his chest is thrown out, and his tail is held at a steep angle as he waddles about on his short legs. Soon he flies away and brings his lady love a peace offering, a sand eel, curving in a circle around his bill like an engagement ring. As he struts around her with it she seems to beg for it with open mouth, waddling up to him with half-raised wings. Finally he offers it to her and she accepts it; perhaps they pass it back and forth again before she swallows it; but at length the conjugal pack seems sealed and they fly away. Sometimes this little ceremony is interrupted by the arrival of a second male with another sand eel which he offers to the same female. She seems willing to accept the offering from either suitor until a fight ensues and one of the males is driven away.

Nesting.—Nest building for the common tern is not an elaborate operation, for many of them build no nest at all, merely excavating a slight hollow in the sand or on a pebbly beach. The windrows of seaweed or dry eelgrass, just above high-water mark, are favorite nesting sites, and here the bird makes a small cavity by beating down the soft mass with a circular movement of its body. On Muskeget Island nests are scattered everywhere over the sand hills, among the beach grass or ivy, along the higher portions of the beaches, about pieces of driftwood and in entirely open situations. Generally some nesting material is brought in—seaweed, grasses, bits of twigs, and other rubbish. These the bird molds into a circular hollow with its body, and in this way elaborate nests are sometimes built, but they always harmonize with their surroundings.

The first eggs are laid on Muskeget between the middle and end of May, the date of laying being more dependent on the weather than on the date of the arrival of the terns. Comparatively few eggs are laid in May, the greater portion being laid during the first two weeks in June and plenty of fresh eggs may be found up to the Fourth of July. Formerly, when much disturbed, egg laying was prolonged through August, but now only a few belated sets are to be found in that month. One egg is laid each day until the set is complete, which normally consists of three eggs, often four, sometimes five, and very rarely six. Frequently, sets of four, and usually the larger sets, show evidence of having been laid by two birds, either by marked difference in color, shape, or size, or by different degrees of incubation. Many eggs are dropped indiscriminately anywhere, probably by birds unable to reach their nests in time, and left to bleach in the sun. Such eggs are often broken, as if dropped by birds in the air.

On the islands near Penobscot Bay, Maine, which are mostly high and rocky or covered with grass, I have examined a number of small breeding colonies of common terns. The nests were on the higher portions of the islands in open situations, either on bare rocky or stony ground or in the short grass, frequently near or even on pieces of driftwood or bunches of seaweed. They were merely slight hollows in the ground, carelessly lined with bits of straw, grass, or rubbish. Once I saw a broken sea-urchin's shell half inclosing one of the eggs. There are numerous small and several large breeding colonies scattered along the New England coast where the terns adapt their nest building to the conditions existing. These are almost invariably on islands, and generally on small islands, which are inaccessible to predatory animals. Notable among these are Penikese and Weepecket Islands, south of Buzzards Bay, Massachusetts, where both the common and roseate terns breed in large numbers, nesting among the stones and rocks on the beaches or on the grassy uplands. Occasionally a nest is found lined with small stones, as if collected for that purpose. On Cobb's Island, Virginia, and on the adjacent islands, we found a few small colonies of common terns, nesting on the beaches with the gull-billed terns and black skimmers, and on drift seaweed in the marshes. Mr. B. S. Bowdish (1910) mentions a colony of 250 common terns breeding on Royal Shoals, a low sand spit on the coast of North Carolina, together with least terns, black skimmers, and laughing gulls. The most southern breeding colony I have ever seen was in the Breton Island reservation off the coast of Louisiana, a small colony of about 25 pairs on Battledore Island scattered among the large breeding colonies of laughing gulls and black skimmers.

In Lake Winnipegosis we found a number of large colonies, on small rocky or stony islands, breeding in company with ring-billed gulls, double-crested cormorants, and white pelicans. Some of these colonies contained over 1,000 pairs of terns, nesting in dense groups

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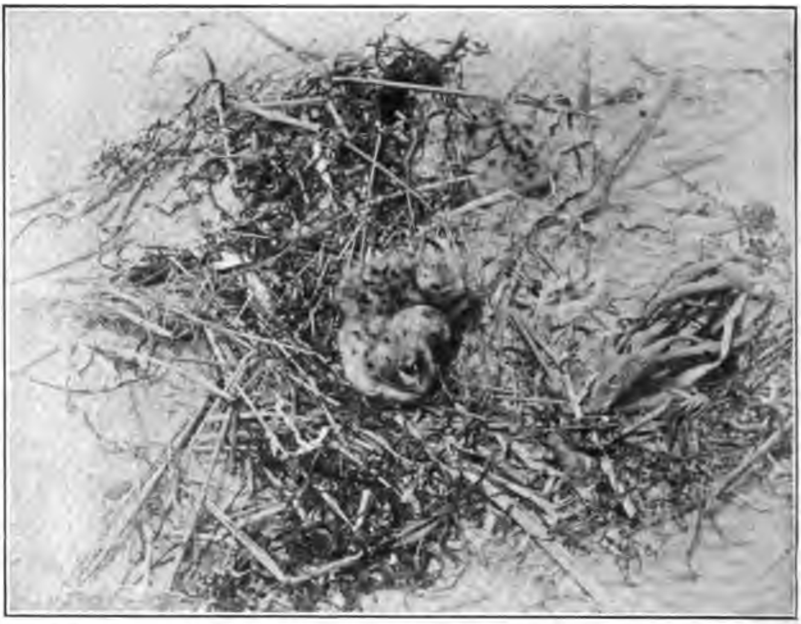
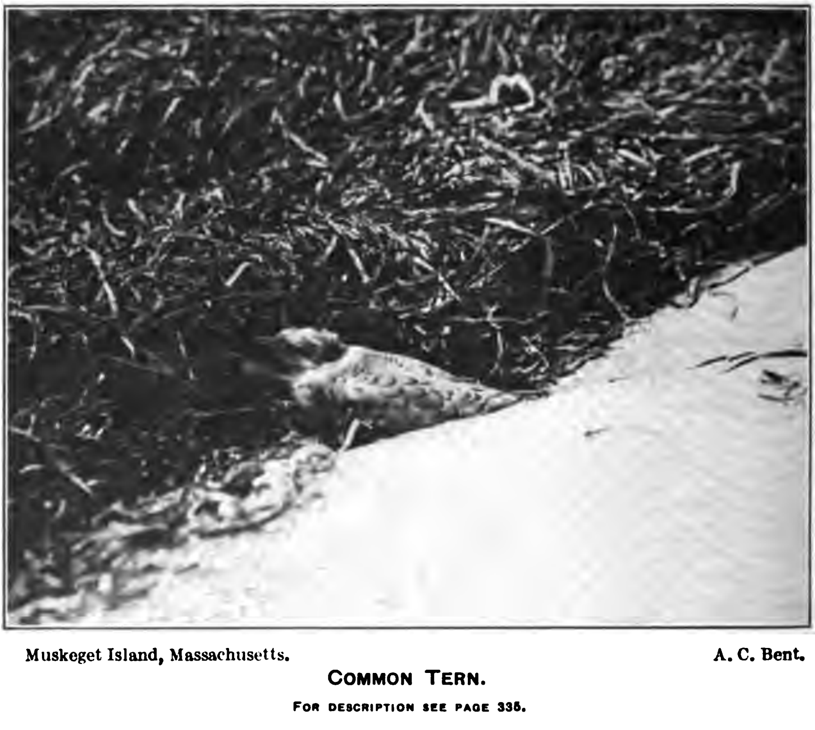


Chatham, Massachusetts. A. C. Bent.



Muskeget Island, Massachusetts. A. C. Bent.

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on the pebbly beaches. Often the nests were not over 2 or 3 feet apart and often within that distance of the gulls' nests.

Eggs.—The eggs of the common tern vary in shape from ovate or short ovate to elongate ovate. The ground color varies from "pale buff" or "olive buff" in the lightest eggs to shades of "wood brown," "cinnamon," or "Isabella color" in the darkest eggs. I have one egg in my collection which is "pale turquoise green"—a rare type of coloration. There is a great diversity of color patterns in the markings, but most of the eggs are quite heavily spotted with various shades of dark brown and drab, "hair brown," "Vandyke brown," "seal brown," or "clove brown." Some eggs are sparingly spotted and others quite densely covered with small spots or dots; some are boldly marked with large blotches of dark colors or heavily splashed with lighter shades; many have underlying splashes or blotches of "olive gray" or "lilac gray," producing handsome effects. The measurements of 82 eggs, in the United States National Museum, average 41.5 by 30 millimeters; the eggs showing the four extremes measure 45 by 31.5, 44 by 32.5, 35.5 by 28.5 and 41 by 27.5 millimeters.

Young.—I believe that only one brood is normally raised in a season, although it frequently happens that the first set of eggs or young is destroyed, making a second attempt necessary; but Prof. Lynds Jones (1906), who has made a careful study of this species, has produced some evidence to indicate that two broods are often raised. It does not seem to me, however, that his evidence is conclusive. He has worked out the period of incubation as 21 days and has given a very accurate account of the development of the embryo. I can hardly spare the space to quote from his excellent paper on the subject as freely as it deserves, but the following two passages are well worth repeating:

> Both male and female take regular turns sitting, but my observations indicate that the female spends more time on the nest than the male. In the cases studied, a bird, later found to be the female, approached the nest abruptly and settled upon the eggs without any preliminaries. She remained quiet 40 minutes, when she uttered a peculiar call, which was repeated at short intervals, until a bird separated itself from the hovering cloud or company at the water's edge, when she stood up, took a few steps, and flew away. The male alighted on the sand several rods to leeward of the nest and approached it gradually, simulated feeding, and called loudly at intervals. When he reached the nest he merely stood over the eggs to protect them from the scorching rays of the sun and kept calling at intervals. In 20 minutes he became more restless, called more frequently, and soon ran some distance to windward of the nest and took wing. Within a few minutes the female alighted on the sand near the nest and went abruptly to it and settled upon the eggs. This maneuver was repeated many times, with slight modifications.
>
> How do the old birds recognize their own young among the multitude of young birds congregated on the beach? was a question which occupied a good deal of

my attention and interest. After the young leave the nest and its vicinity they wander about aimlessly and may be at widely different places at two visits of the old birds. Hence it is often a serious question on the part of the parent how to find its offspring. Abundant opportunity was afforded for studying this question. Old birds with young which had left the nest, when coming in with a fish, stooped to examine each group of young in turn until a young bird, apparently its own, was found, when the old bird alighted. Immediately the youngster began to dance and call vociferously, but not until the old one had touched the young one with its forehead was the question decided. Often this minute inspection was immediately followed by the departure of the old bird without delivering the fish, the quest for its own young being renewed. It thus became clear that sight alone was not depended upon for recognition, but that the final decision rested upon the sense of smell. Sometimes the quest resulted in failure, when the old bird swallowed the fish. The evidence seemed to indicate that these terns feed only their own young.

By the 1st of July on Muskeget probably the majority of the young terns have hatched in nests which have not been disturbed. Under favorable weather conditions the eggs are often left uncovered, the sun and the warm sand supplying the proper amount of heat; but the birds seem to be able to judge these conditions quite accurately, for in cold, cloudy, or rainy weather, when the eggs might become chilled, or, on the other hand, when the sun is too hot for them, I have always found the birds anxious to return to their nests and protect their eggs. I think they always incubate at night. Terns are seldom seen on their nests because they are timid and restless, but they will soon return to them if the intruder remains quietly concealed at a safe distance. The hatching process is often slow and laborious, a day or more intervening between the time when the horny tip of the bill makes a small hole near the larger end of the egg and the actual hatching time, when the weak, wet little chick emerges from the shell. It dries off within a few hours and remains in the nest for two or three days. Its eyes are open at birth, but it is not fed until the second day. It is fed on small fish from the very first, which it swallows head first. When three or four days old the young chick becomes very lively, running about rapidly, hiding in the grass or between stones, or even lying flat on the sand, where its protective coloring helps to conceal it. It seems to realize this fact, for I have often seen one remain perfectly motionless until it felt sure it was discovered, after which its capture was far from easy. Parents must experience considerable difficulty in finding their own young, and still more trouble in protecting them against inclement weather. On July 4, 1903, I noticed evidences of great mortality among the very young chicks on Muskeget; I found hundreds of their little dead bodies scattered over the island, drying in the sun, sometimes two or three in one nest, and once I saw the dead body of an adult tern covering the bodies of two young in the nest. Captain Gibbs, of the life-saving station, thought that they were killed by exposure to pro-

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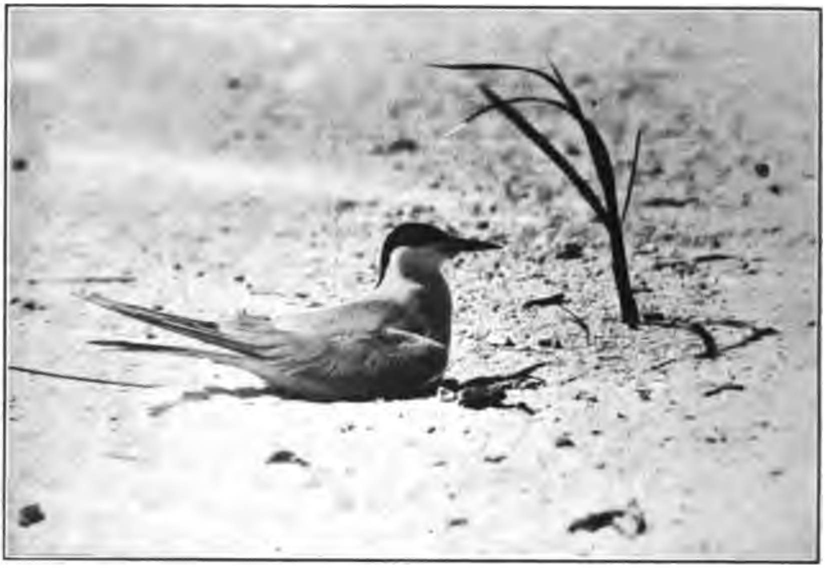
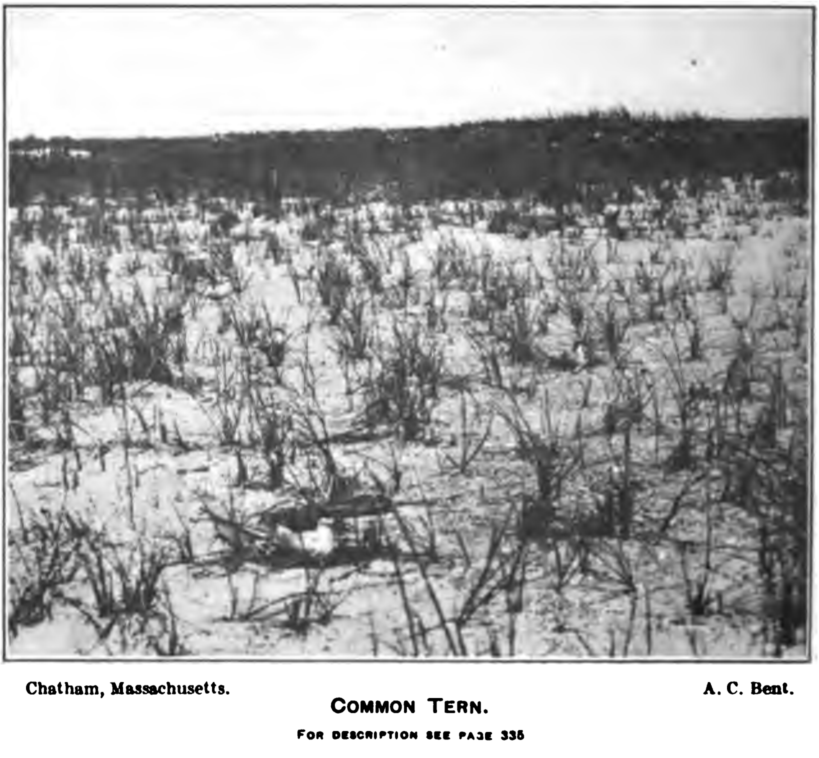


Chatham, Massachusetts. A. C. Bent.



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longed, cold, easterly rainstorms which prevailed during the previous month. Probably the older young were able to run to shelter under the ivy vines, bushes, and thick grass, and thus survived. On certain portions of the island, where the grass grew tall and thick, the mortality was much less noticeable.

The young are fed by their parents until they are fully grown and well able to fly and have been taught to fish for themselves. I have seen young birds fully as large as their parents and in the first winter plumage fed in this way while standing on a sand bar or sitting on the water. As the old bird approaches with a small fish held crosswise in its bill the youngster shows its excitement by fluttering its wings rapidly, screaming and throwing back its head, with open mouth ready to receive the coveted morsel, while the parent hovers over it and feeds it. I have never seen the feeding process performed on the wing.

Dr. Charles W. Townsend contributes the following notes on the feeding of the young:

> The full-grown young appear to be always hungry and call in a monotonous, beseeching way whenever an adult appears with a fish. There are three methods of receiving the fish from the parent—either in the air, on the sand, or on the water. There can be no doubt that the hungry and clamorous young will take food from any adult. Whether the adults feed any but their own young and whether they are able to recognize their own is of course a question. I am inclined to think that, although an adult may occasionally feed a clamorous youngster not its own, as a rule it refuses to feed any but its own legitimate offspring, which it is perfectly able to recognize. As the sexes of the adults are alike in plumage it is difficult to tell whether only one or both parents feed the young.
>
> In the air the feeding of the young is often a graceful and interesting performance. By a series of aerial evolutions the adult and young reach a point where the transference of the fish directly from bill to bill is made so quickly that one often can not be sure whether the fish was thrown or dropped or actually passed from mouth to mouth. I am inclined to think all methods are used.
>
> On the sand the young sometimes collect in numbers while the adults fish for them. Although the young, easily recognized by their white foreheads and black bills, generally stand motionless, they sometimes walk about, often more rapidly than adults are in the habit of doing. When an adult flies toward a group with food the young all clamor at once, opening their black bills and displaying their crimson gapes, and crowding up toward the food-bearing adult. On one occasion at Ipswich I saw an adult with a fish in its bill alight on the beach near two immature birds, who both clamored loudly to be fed. Disregarding their cries it flew to a third immature bird, but was soon off and alighted near an adult, to whom it delivered the fish, which was swallowed. The young either swallow the fish at once on the beach or sometimes rise in the air and fly about until the fish disappears down the throat. If the fish is large the swallowing may be a slow process. One young bird after swallowing the fish alighted on the water a moment and appeared to take a drink before rejoining its companions on the beach.
>
> The process of feeding the young bird on the surface of the water is perhaps the most interesting, and points to the former more aquatic ancestry of

the terns. An adult flies screaming with a fish in its bill; the young responds by a beseeching call and flight toward the parent, and alights on the water still calling. The old one flies down and delivers the fish without alighting, or doing so but for a brief moment. The thing is done so quickly that it is often impossible to know what happens. The young one as soon as it receives the fish flies up into the air.

Plumages.—Several very distinct color phases may be found in the downy young of the common tern, each having numerous variations. The commonest type is "cream buff," "ochraceous buff," or "clay colored" above, irregularly mottled with "sepia" or "seal brown;" the throat is sometimes "smoke gray," but more often "drab" or "sepia;" and the under parts are pure white. There is a gray phase in which the back is "pale neutral gray" and the crown "cartridge buff" or "pale olive buff;" it is spotted with black on the upper parts; and the throat is "bone brown." A much rarer type is plainly colored and entirely unspotted. In this type the color of the upper parts varies from "clay color" to "pinkish cinnamon" or "cinnamon buff," shading off to paler tints on the sides and to white on the breast. This type intergrades with the common type, and there is much individual variation in the extent of the dusky throat and its color, which varies from "smoke gray" to "brownish black."

Dr. Jonathan Dwight (1901) describes the molts and plumages of the first year as follows:

> Juvenal plumage acquired by a complete post-natal moult shortly after leaving the egg. Dusky markings and buff edgings are conspicuous above, the lower parts being a clear white. The forehead is pale brown, blending into a dull black occiput. Buffs and browns later become dull white by fading and the blacks become brownish. The forking of the tail is much less than that of adults, and the rectrices are more rounded, darker, and tipped with dusky or buff markings which become largely lost by wear. A couple of rows of lesser coverts along the cubital border of the wing form a dull black band. The flesh-colored bill and feet, after first brightening, begin to darken.
>
> First winter plumage acquired by a partial post-juvenal moult, limited to the body feathers, and sometimes a few of the lesser wing coverts. The new mantle is gray except for the dusky cubital bands. The forehead is white and the occiput black, with some tendency to streaking on the crown. The bill and feet become wholly black. Save for the less forked, darker tail, and traces of buff on the retained wing coverts, young birds closely resemble adults. The change to this plumage is not apt to begin before the end of September on the Atlantic coast.
>
> First nuptial plumage acquired by a complete first prenuptial moult, which explains the freshness of all the feathers of breeding birds. The lateness of this moult in some birds is indicated by over 50 specimens (some of which appear to be adults) taken in Florida between May 28 and June 3, which vary from birds with the first primary barely grown to those still retaining two or three of the old primaries and a number of old rectrices and body feathers. The black cap is now assumed, the dusky cubital bands disappear, and the bill and feet become chiefly coral red.

Occasionally in young birds the first nuptial plumage, described above, is not assumed, but instead a plumage like the adult winter plumage is acquired by a late prenuptial or an early postnuptial molt. This plumage is worn throughout the spring and summer, probably by the less vigorous birds which do not breed. It is the plumage which was once described as a species under the name *Sterna portlandica.*

Adults have two complete molts each year, a prenuptial early in the spring, before their arrival on their breeding grounds, and a postnuptial in September or later. The adult winter plumage is similar to the first winter except for the wings and tail; the latter is shorter than in spring.

Food.—The food of the common tern consists almost wholly of small fish, not over 3 or 4 inches long, such as the sand launce (*Ammodytes americanus*) and the pipe fish (*Siphonostoma fuscum*), and probably the young fry of larger species. Shrimp and aquatic insects are eaten to some extent. Mr. Ora W. Knight (1908) speaks of seeing a tern chase, catch, and devour a yellow swallow-tail butterfly (*Papilio turnus*). The fishermen about Nantucket find the terns very useful in helping them to locate a school of bluefish, for a hovering, diving flock of terns is almost sure to indicate the presence of the fish. The small fry on which the bluefish feed are driven to the surface in dense schools to escape from their enemies below only to be pounced upon by their enemies in the air. It is remarkable to see how quickly the terns will gather, from far and near, as soon as one of their number has discovered such a school. It is an exciting scene, for the water fairly boils with rushing, plunging fish, and the air is full of screaming, fluttering, diving birds; but for the poor fry it is a strenuous struggle for existence.

Doctor Townsend describes its feeding habits as follows:

> The plunge of the common tern resembles in miniature that of the gannet. Down they drop like winged arrows, folding their wings as their bodies enter the water. Often they disappear entirely under the water to emerge victorious, with the fish in the bill, or prepared to try again. They scream their triumph or failure, for they can scream even with a fish in the bill. Sometimes a fish is difficult to swallow, and it is dropped to be caught again before it strikes the water. As the terns leave the water they generally shiver violently, probably to shake off the water. At times they fly down at the beach for a small crustacean or a sea worm. Off the southern Labrador coast I have seen flocks of terns follow small whales and dart down screaming at the water, after the whale had broached and gone down. It is probable that the whale and tern both relish the same small fry.
>
> During the month of August one of this tern's favorite food fishes, the sand eel or sand launce (*Ammodytes americanus*), abounds in the shallow waters about the beaches and inlets at Ipswich, Massachusetts, and thither the terns flock in large numbers from distant breeding places. These fish are 3 or 4 inches long and swim in compact schools of many hundreds. Where

> they abound the terns congregate and busily bombard the water, disappearing completely below the surface in order to capture their prey. As the bird rises from the water, with the fish hanging from its bill, it occasionally throws it into the air either from pure fun or to get a better hold on the fish. Sometimes a bird drops a fish, but catches it again before it has fallen more than a yard or two. The presence of the fish in the mouth never interferes with the capacity of the bird to scream or cry out. In fact, the fish bearer generally screams constantly, as if to announce its success in the chase or the fact of food to its young.

Behavior.—The flight of the common tern, like that of all of its congeners, is light, airy, and graceful. At times it seems listless and desultory, as it flits along the shore looking for its prey, the slow beats of its long wings lifting its light body at every stroke; but again it is swift and direct when traveling high in the air or when hurrying to join a bevy of its fellows hovering over a school of fish; but always the bird has better control of its movements than it appears to have. Its diving habits have been described above. It seldom indulges in swimming, though it can do so if necessary. On hot days large numbers may sometimes be seen swimming and bathing.

In life the common tern can not be easily distinguished from the Forster's tern, and it still more closely resembles the Arctic tern; the movements of all three are almost exactly alike, and the common tern is intermediate in color between the other two. Its voice will distinguish it from the former, but not from the latter. Its somewhat harsh rolling call, "tee ar-r-r-r-r," is almost musical at times and has a decidedly pleasing cadence, a tinge of wildness, associated with the poetry of summer seas. There is a delightful variety in its notes, with the repetition of the same theme, varying in rapidity and tone, expressive of its various moods. Doctor Townsend writes to me in regard to it:

> I have had them fly directly at my head to within a few feet, when they suddenly swerve upward. As they dart down they emit in their rage a rapidly repeated and vibratory tut tut or kik kik kik, followed by a piercing, screaming tear. These sharp rapidly repeated notes are sometimes followed by a loud rattling sound, as if the mandibles were vibrated in anger.

The Muskeget terns have suffered seriously at times by the introduction of cats, kept by the life-saving people, which also nearly exterminated a local species of field mouse (*Microtus breweri*). Perhaps their worst enemy, next to man, has been the short-eared owl. A colony of these owls lived on the island, making their home on some high grassy knolls, about which hundreds of dead terns lay, partly eaten and drying in the sun. Mr. William Brewster (1879) has thus described their destructive work:

> Every day at a certain time these owls sallied forth in search of fresh prey. We used regularly to see them about sunset, sailing in circles over the island

> or beating along the crests of the sand hills. They were invariably followed by vast mobs of enraged terns, which dived angrily down over the spot where the owl had alighted, or strung out in the wake of his flight like the tail of a comet. The owl commonly paid little attention to this unbidden following, apparently never tried to seize his persecutors while on the wing, but on several occasions we saw a sitting bird pounced upon and borne off. Sometimes in the middle of the night a great outcry among the terns told where a tragedy was being enacted.

Fortunately for the terns, but unfortunately for the cause of science—for the owls were supposed to be approaching subspecific distinction—this little colony of interesting owls was entirely wiped out during the summer of 1896, through the misdirected ardor of a bird protectionist. Furthermore, as the owls destroyed large numbers of the mice, which probably destroyed many of the eggs of the terns, perhaps it would have been better to have left nature's balance undisturbed.

A very large colony of terns at Chatham, Massachusetts, was practically exterminated by a colony of skunks in 1917 and 1918.

Dr. Townsend writes:

> The common tern appears to be one of the favorite victims of jaegers, but the worm sometimes turns and chases the jaeger in return. Once in mid-August, on the Maine coast, I found a common tern chasing a male sharp-shinned hawk. The latter twisted and turned, but was unable to escape his adversary until he took refuge in an alder thicket, around which the tern flew screaming in anger.

Dr. Louis B. Bishop sends me the following interesting notes on the behavior of terns on an island in Stump Lake, North Dakota. He says:

> On the third island we found the terns killing the young ring-billed gulls by chasing them till they took to the water, then descending on their heads in a perfect shower, striking at the back of their heads until they had pierced their brains. We saw three killed in this manner in less than half an hour, two more before we left, and many bodies of those killed before. The old gulls seemed to pay no attention to them.
>
> I remember it as if it were yesterday. Eastgate and I had seated ourselves on the bank of the high island, and the adult gulls had gone offshore. Suddenly we noticed the terns screaming loudly and diving at something in the high weeds. Wondering what was the matter we watched, and soon saw a young gull make its way to the water with the terns diving at it. When it swam from shore the terns simply rained on it. The gull was, I think, just out of down. As the terns descended, the little gull tried to strike back, but presently a tern struck it on the back of the head, and its head fell to one side. Soon it came to life again, when the terns again descended until its head fell to rise no more. Then the terns left it to chase up others. We tried to save some of these young gulls by shooting the terns that were attacking them, but to no avail; the other terns paid no attention to those who were killed, or to the reports of the gun. They were more anxious to kill the young gulls than to save their own lives. We picked up several of the young gulls thus killed, and the backs of their heads, where merely a membrane covers the brain at this age, looked like pincushions. The only explanation I could think of was

that the adult gulls ate the terns' eggs and young, and the later were taking their first chance to retaliate. This theory was strengthened by the fact that we did not find nearly as many young terns as there ought to have been with a colony as large as this.

Fall.—As soon as the young are able to fly, usually in August, many of the terns desert their breeding grounds and wander about the shores in loose scattering flocks, free from the arduous cares of reproduction, to spend the remainder of the season in rest and recreation. They are still largely gregarious and may be seen resting on the sand bars or sandy beaches in large compact flocks, all facing the wind. Some may be bathing in the shallow waters or preening their immaculate plumage, while others stand and sleep with bills buried under the scapulars. As the rising tide encroaches on their roosting ground those nearest the water are forced to rise, and flying over their fellows, to alight above them on the sand. Birds are constantly coming and going, making an animated scene of lively interest. Their summer wanderings are often extended over long distances in search of food. Large numbers of terns are seen daily, flying high in the air over Cape Cod to their favorite feeding grounds in Massachusetts Bay, spending the day on the sandy beaches near Plymouth and returning each night to their breeding grounds south of Cape Cod, 25 or 30 miles distant. The fall migration begins on the coast of Maine by the middle or last of September. In Massachusetts there are a few scattering winter records, but as a rule they begin to leave early in October, and by the end of that month nearly all of the common terns are gone. Winter records along the Atlantic coast seem to be scarce north of Florida, and probably most of the common terns spend the winter from the Gulf of Mexico southward.

DISTRIBUTION.

Breeding range.—Along the Atlantic coast of North America from northern Nova Scotia (Cape Breton) south to North Carolina (Pamlico Sound); and in the interior, south to the Gulf of St. Lawrence, the St. Lawrence River, northern Ohio (Oberlin and islands in western Lake Erie), southeastern Michigan (St. Clair Flats), southern Minnesota (Heron Lake), northern North Dakota (Devil's Lake region), and southwestern Saskatchewan (Crane Lake region). West to southeastern Alberta (Many Island Lake) and central Alberta (near Edmonton). North nearly, if not quite, to the Arctic coast of Mackenzie, certainly to Great Slave Lake (Fort Providence) and the west coast of Hudson Bay. A few birds breed in Bermuda, the Bahamas, and the Florida keys, on the coast of Venezuela (Aruba and Bonaire Islands) and on the coasts of Alabama, Louisiana, and Texas (Matagorda). In Europe, from Norway to the Mediterranean, Black, and Caspian Seas, in the Azores.

Canary, and Madeira Islands; in northern Africa and in temperate Asia, from Turkestan to Lake Baikal.

Winter range.—A few birds winter as far north as Florida (St. Johns River), but the main winter range is in South America, all along both coasts, as far south as the Straits of Magellan. In the Eastern Hemisphere, Africa, ranging to the Cape, and southern Asia.

Spring migration.—Early dates of arrival: Masaschusetts, April 20 to 25; St. Lawrence River, May 20; Pennsylvania, Erie, April 26; Ohio, Columbus, April 4; South Dakota, April 20; Colorado, New Windsor, May 14; California, Point Pinos, April 29. Late dates of departure: Brazil, Barra, May 1; Chile, Valparaiso, April 23; Peru, Ancon, May 10.

Fall migration.—Early dates of arrival: Argentina, Mar del Plata, September 18; Chile, Valparaiso, September 17; Straits of Magellan, Punta Arenas, November 19. Late dates of departure: Massachusetts, Barnstable, November 14, and Woods Hole, December 2; Pennsylvania, Erie, September 26; Ohio, Cincinnati, November 11; British Columbia, Comox, September 24; California, Point Pinos, October 17; Lower California, San José del Cabo, September 30.

Egg dates.—North Dakota, Saskatchewan, and Manitoba: Thirty-six records, May 31 to July 15; eighteen records, June 11 to 21. Virginia: Thirty-five records, May 27 to July 19; eighteen records, June 11 to 27. Maine: Twenty-one records, May 29 to July 26; eleven records, June 14 to July 4.

STERNA PARADISAEA Brünnich.

ARCTIC TERN.

HABITS.

Contributed by Charles Wendell Townsend.

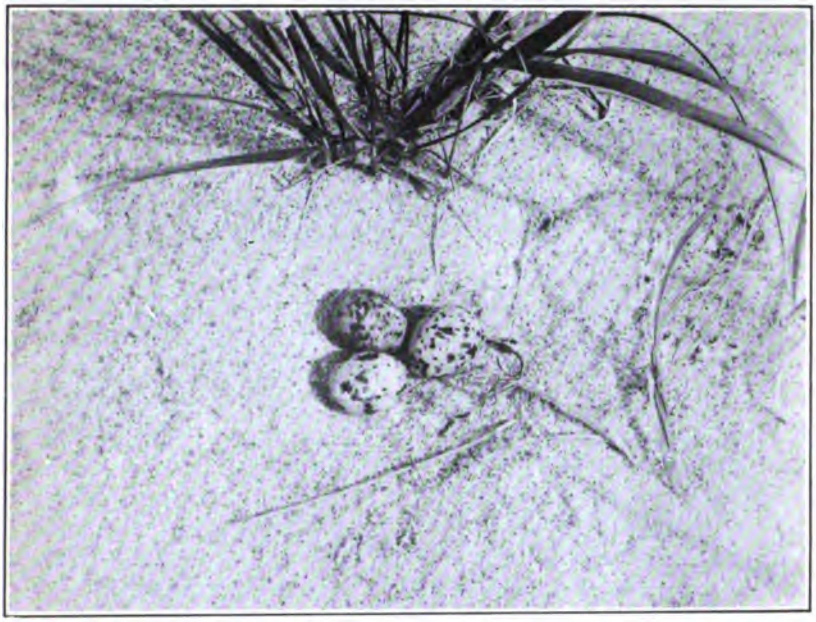
The casual observer, fascinated by the sight of a flock of graceful terns diving for fish on the New England coast, naturally supposes they are all of one kind, and is told they are mackerel gulls. The ornithologist enjoys the same esthetic charm in the sight, but has often the added intellectual pleasure of discovering several distinct species in the flock. Common terms are generally in the majority but arctic and roseate terns may also be seen, as well as least and black terns. It would be difficult to point out to the untrained observer the differences between the common and arctic terns, but they can be recognized with a little practice and without the use of the gun. The feeding and nesting habits, mode of flight, size, and general appearance of these two species are, however, very much alike.

The Arctic tern breeds throughout the entire circumpolar regions as far north as it can find land, and south in this country to northern

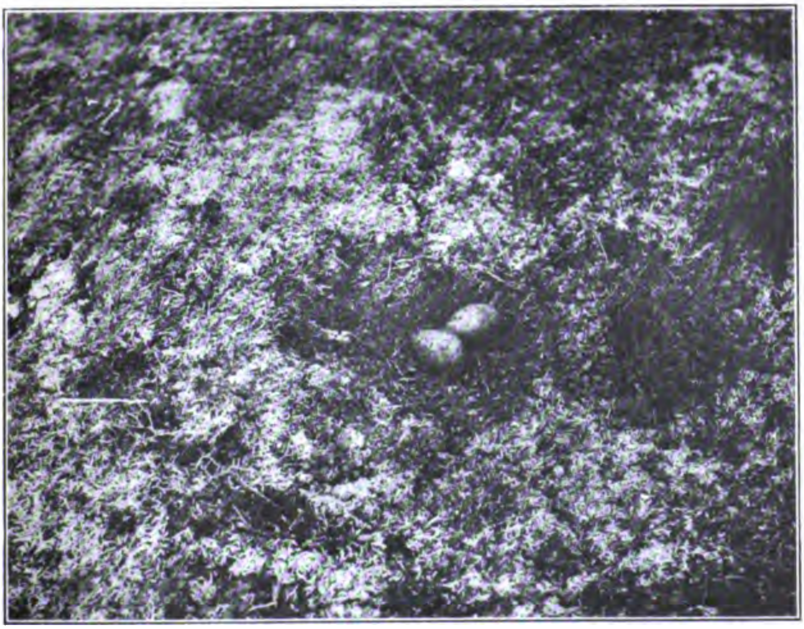
British Columbia, Great Slave Lake, Central Keewatin, Maine, and Muskegat Island, Massachusetts. It is credited by Cook (1911) with being "the world's migration champion." After the breeding season is over the bird repairs from the Arctic to the Antarctic regions. "What their track is over that 11,000 miles of intervening space no one knows," says Cooke (1911).

> A few scattered individuals have been noted along the United States coast south to Long Island, but the great flocks of thousands and thousands of these terns which alternate from one pole to the other have never been met by any trained ornithologist competent to learn their preferred path and their time schedule. The Arctic terns arrive in the far north about June 15 and leave about August 25, thus staying 14 weeks at the nesting site. They probably spend a few weeks longer in the winter than in the summer home and, if so, this leaves them scarcely 20 weeks for the round trip of 22,000 miles. Not less than 150 miles in a straight line must be their daily task, and this is undoubtedly multiplied several times by their zigzag twisting and turning in pursuit of food.
>
> The Arctic terns have more hours of daylight and sunlight than any other animal on the globe. At their most northern nesting site the midnight sun has already appeared before their arrival, and it never sets during their entire stay at the breeding grounds. During two months of their sojourn in the Antarctic they do not see a sunset, and for the rest of the time the sun dips only a little way below the horizon and broad daylight continues all night. The birds therefore, have 24 hours of daylight for at least eight months in the year, and during the other four months have considerably more daylight than darkness.

Spring.—The most southern breeding place of the Arctic tern seems to have been Muskegat Isle, off Nantucket. Mackay (1897) gives the earliest date for the arrival of terns at this island as May 3, in 1897. The day before no terns were to be seen, while on the third they arrived "in large flocks, thousands dropping from the sky when they were first observed." The larger part of these were common and roseate terns, but he found a few Arctic terns breeding. When I visited this island in 1913 about 20,000 common terns, 1,000 roseate terns, and 3,000 laughing gulls were breeding, and I feel fairly sure that I saw a couple of Arctic terns, so there is a possibility that they still breed there. They were found breeding at Beverly in 1846 by Cabot (1846) and at Ipswich between 1868 and 1870 by Maynard (1870). They no longer breed there. On the Maine coast the Arctic tern, like the common tern, has steadily increased in numbers under protection since its low ebb due to the war of the milliners in the late nineties. Its chief breeding grounds there, according to Knight (1908), are Metinic, Green, Machias Seal Islands, and Matinicus Rock, where it nests with the common tern. It arrives from the south from the middle to the last of May. Its arrival on the southern coast of Labrador is at about the same time. Turner



Chatham, Massachusetts. A .C. Bent.



Yukon Delta, Alaska. F. S. Hersey.

ARCTIC TERN.

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(1886) says that this tern is one of the earliest birds to arrive at St. Michael, Alaska.

> The earliest date recorded was April 25,, a very early season, showing that the terns only await the movement of the sea ice to appear in any locality. They become very abundant by the middle of May.

Murdoch (1885) reports that the tern arrives at Point Barrow, Alaska, about June 10.

Nesting.—The Arctic tern prefers to breed in colonies of its own species, but it is not rare to find a few common terns in these colonies or to find a colony composed largely of common terns with a few arctic terns. In Alaska they are often associated with Aleutian terns. Turner (1886) says their nests are sometimes placed within 2 feet of each other, and apparently without causing animosity between the species. Sandy or rocky islands are usually chosen, and the nests are scattered more or less thickly over the ground. Grinnell (1900) states that in Alaska he did not find the bird in colonies, as two nests were seldom within a hundred yards of each other; usually only one pair were found at a pond. Small islets were often selected, but he occasionally found this species nesting on the tundra a quarter of a mile from the nearest lake.

Nelson (1888) says:

> Along both shores of Bering Sea and upon both shores of the adjoining Arctic waters this bird is very common. It nests wherever found in this region, and occurs indifferently either in the interior along the courses of the rivers, or on the salt marshes and barren islands on the seacoast. * * * It nests on some of the sterile islands of the North, in flocks, upon the bare sandy or pebbly ground, with no trace of any artificial nest. * * * On the eastern shore of Bering Sea I have only found it nesting singly, in pairs scattered here and there over the marshes, and in one instance three pairs were found occupying the same small island in a lake, which is the largest number I found nesting in close proximity.

This goes to show, as he says, "that the birds' habits vary greatly with the locality." Hinckley (1900) found the Arctic tern nesting along the Sushitna and Kuskokwim Rivers "even in high mountain valleys." Turner (1886) says:

> They breed in the low grounds, preferably a low, damp island, such as those at the northern end of the canal. At this place hundreds of nests were discovered in 1876.

Feilden (1877) found several pairs of Arctic terns breeding in latitude 81° 44′ on Bellots Island, on August 21. The land was covered with snow, and from one nest, in which was a newly hatched tern, the parents had thrown out the snow so that the nest was surrounded by a border marked by their feet 2 inches above the general level.

The Arctic tern is more inclined to omit nesting material than is the common tern, and its nest is generally merely a hollow in the sand, gravel, or moss or in the rocks. Occasionally a thin lining of dry grasses is used, but an elaborate nest is rarely or never seen. Turner (1886) says:

> The nest is merely a bare spot on the ground. Sometimes a few blades of grass surround the margin of the nest, but these seem to be more the result of cleaning off a bare spot than an attempt to construct a nest.

Palmer (1890), who found this the only species of tern at Funk Island, says that the eggs were laid on the bare rocks, often with broken pieces of granite or pebbles sometimes gathered from a distance arranged about them in a circle. In some cases he found bones of the great auk used in the same manner. Occasionally the eggs were laid in depressions in the gravel, among mussel shells, in crevices, amid tangled masses of chickweed 6 inches high that was dead, in a circle 5 inches about; also in depressions in dead grass as if a mouse's nest had been appropriated. McGregor (1902) says:

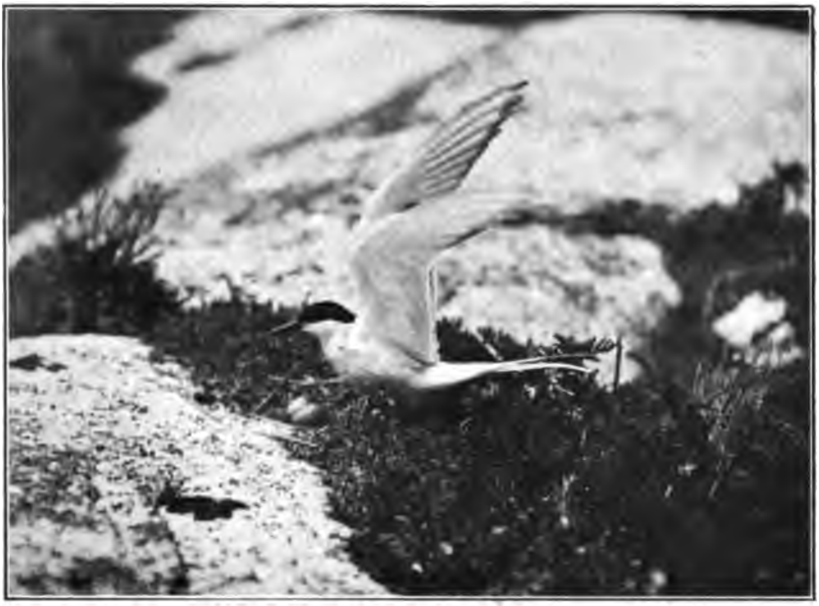
> A typical nest was a depression 1 inch deep by 5 inches in diameter, lined with dry grass and weed stalks.

Parry (1824) says:

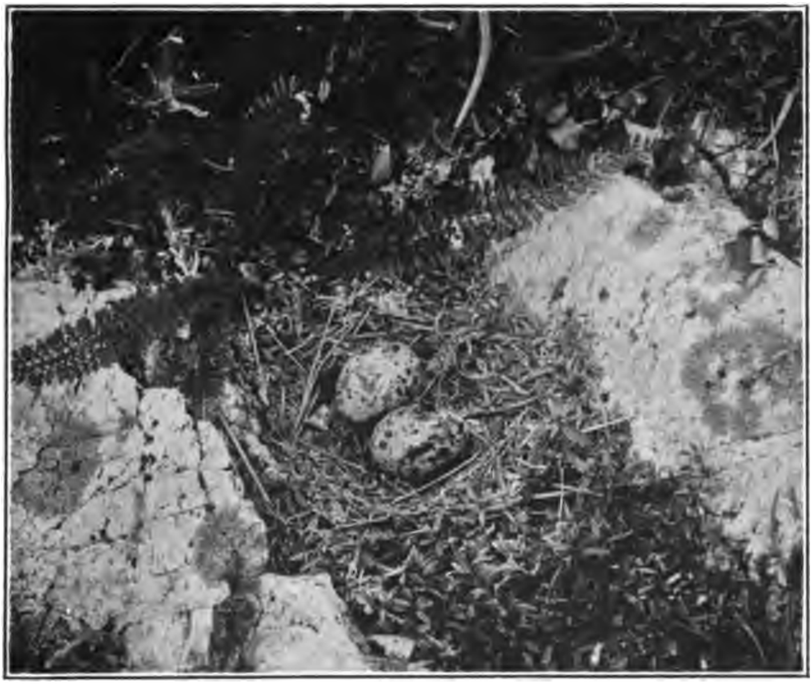
> The nest in which the eggs are deposited, and each of which generally contained two, consisted merely of a small indentation in the ground, without any downy feathers or other material.

[Author's note: *Eggs.*—The Arctic tern raises only one brood in a season and the set usually consists of two eggs; three eggs are often laid, but larger numbers are very rare. A very large majority, or nearly all, of the sets collected in the far north consist of two eggs. The eggs can not be distinguished from those of the common tern by any constant or even prevailing character, though they seem to average a trifle darker in color and more rounded in shape, which varies from ovate to rounded ovate. The ground color varies greatly; in the darkest eggs it is "Brussels brown" or "Dresden brown"; in others it is "Saccardo's olive," "écru olive," or "dark olive buff"; and in the lightest egg "water green" or "pale olive buff." The eggs are more or less irregularly spotted or blotched with the darker shades of brown, such as "chaetura black," "bone brown," or "chestnut brown," and often there are underlying spots of various shades of "brownish drab" or "écru drab." The measurements of 123 eggs in the United States National Museum average 41 by 29.5 millimeters; the eggs showing the four extremes measure 46 by 32 and 37 by 27 millimeters.

Plumages.—The period of incubation is probably about 21 days. Both sexes incubate. The downy young of the Arctic tern may be distinguished from that of any other American tern by the black or dusky frontal space, which includes the lores and extends across the base of the bill. This dark area matches in color the dark-colored



Matinicus Rock, Maine. H. K. Job.



Matinicus Rock, Maine. H. K. Job.

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throat, which varies from "dusky drab" to nearly black. The breast is pure white, becoming more grayish posteriorly. The upper parts show at least two distinct color phases, both of which are sometimes found in one brood. In the brown phase the head, back, and wings vary from "cinnamon" to "pinkish buff." In the gray phase these parts are "pale drab gray" or "pale smoke gray," shading off gradually into the white or paler color of the under parts. In both phases the head is distinctly spotted and the back is heavily mottled or variegated with "fuscous" or black; the markings are usually blacker in the brown phase than in the gray. The plumage appears first on the wings and scapulars, then on the sides of the breast, and the last of the down is seen on the head.

The juvenal plumage is fully acquired by the time the young bird is fully grown. In this plumage the forehead and crown are grayish, the latter mottled with black, which increases on the auriculars and occiput to practically solid black. The back and wings are "deep gull gray," each feather of the back, scapulars, and wing-coverts being edged with pale buffy, with a subterminal dusky band and fine dusky sprinkling; these markings are most conspicuous on the scapulars. The tertials, secondaries, and inner primaries are broadly edged with white. There is considerable dusky and some pale buff near the ends of the tail feathers. The under parts are white, washed with pale brownish tints on the throat, breast, and sides. This plumage seems to be worn until the birds leave in September, but it is probably partially molted in the fall to produce the first winter plumage, which is similar to the adult. Subsequent molts and plumages are apparently similar to those of the common tern, including the *portlandica* plumage.]

Food.—The food of the arctic tern is the same as that of the other terns found in the same region, and consists chiefly of small fish, such as capelins, and sand eels or sand launces, and the fry of larger fish. Small crustaceans are also eaten. The method of capture is the same as in the case of the other terns. Scanning the water with down-turned head and bill from a height of 30 or 40 feet, this little tern falls with the speed of an arrow, strikes the water with a splash, and often disappears completely below the surface in order to capture its prey. As it rises from the water it shakes its plumage vigorously, and the fish may be seen hanging from the bill. Occasionally it throws the fish into the air either for pure fun or to get a better hold. Sometimes the tern drops the fish but catches it again before it has fallen more than a yard or two. The presence of the fish in the bill never interferes with the capacity of the bird to scream or cry out. In fact the fish bearer generally screams constantly as if to announce its success in the chase.

Behavior.—I have known them to fly directly at my head to within a few feet, when they suddenly swerve upwards. As they dart down they emit in their rage a rapidly repeated and vibratory *tut tut* or *kik*, *kik*, *kik*, followed by a piercing, screaming *tearr*, which is shriller than that of the common terns and ends in a rising inflection, which has been well characterized by Brewster (1883) as "sounding very like the squeal of a pig." He says "the bird also has a short, harsh note similar to that of Forster's tern." Grinnell (1900) says that the teasing cries of the young "closely resemble the usual note of the white-throated swift in California."

The Arctic tern, like the common tern, kittiwake, and others, is frequently harassed by the various species of jaegers, and after much twisting and turning is forced to drop the fish, which is at once snapped up by its pursuer. Although terns frequently quarrel among themselves, the various species often rest peaceably together. The former pernicious practices which led to the almost complete annihilation of terns for millinery purposes have already been described at length under the common tern. It is fortunate that these days of slaughter are passed. The increase of terns along the New England coast in the last 10 or 15 years has been very marked. In regions where game laws are but little understood or regarded the killing of such easy victims as terns still goes on. I have seen on the Labrador coast both common and Arctic terns that had been shot to feed captive black foxes.

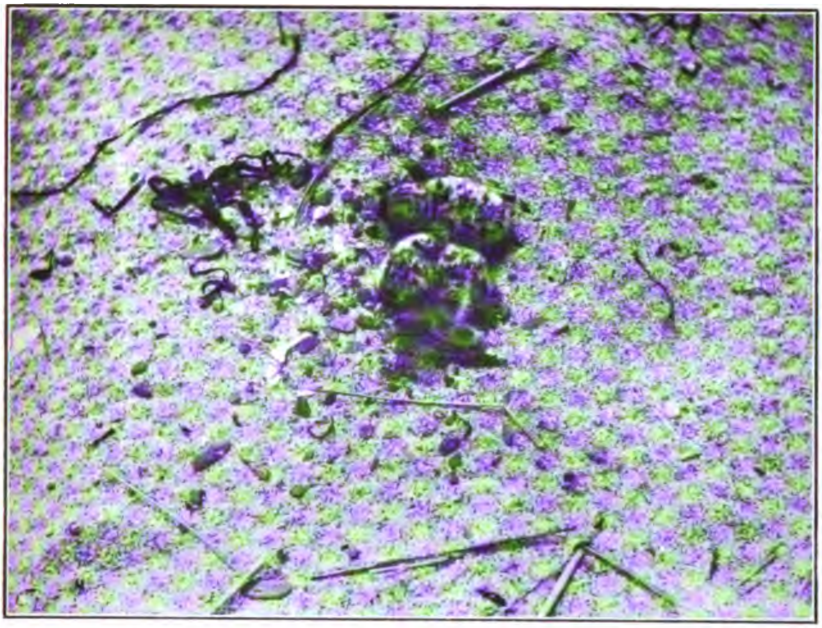
Dutcher (1903) quotes Norton in regard to mortality among the young of the Arctic tern on the Maine coast as follows:

> Abundant as they were living, I noticed quite an extensive mortality among the downy young, and their decaying bodies were scattered over the island. There was no visible cause, but two things suggested themselves—one an epidemic; the other that the damp, cold summer just passed had not supplied sufficient warmth and sunlight to keep them from being chilled.

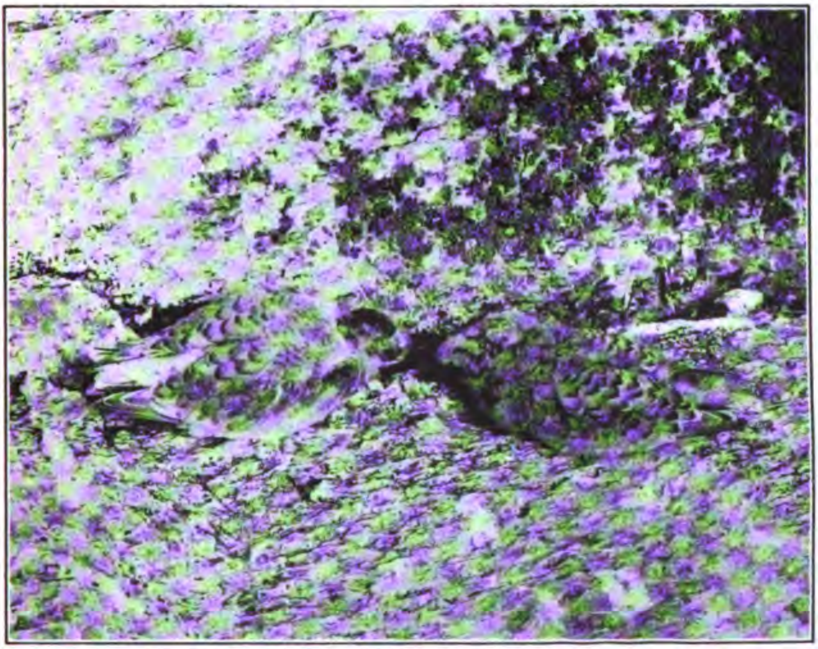
In another place (1905) he quotes Capt. James Hall, of Matinicus Rock, Maine, as expressing "the belief that food is scarce and starvation is the cause of much death late in the summer." Palmer (1890) says:

> In no other species of bird with whose breeding habits I am familiar has nature been so prodigal of life as in the case of the young terns on Funk Island. The surface of the granite rock of the island has been corroded by time and the elements to such a degree that many shallow depressions have been rotted as it were. These have been filled with water by the abundant rain and form veritable death traps to the young terns. Many of them leave the nest when a few days old and wander about. Numbers are thus lost among the rocks and drowned while trying to get back to their parents. This explanation seems to me to account for the numbers of dead young found in the pools.

It is possible, however, there may be some other explanation, for young terns are expert swimmers.



Chatham, Massachusetts. A. C. Bent.



Matinicus Rock, Maine. H. K. Job.

ARCTIC TERN.

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DISTRIBUTION.

Breeding range.—Circumpolar. In North America, south on the Atlantic coast to Massachusetts (Muskeget Island); in the interior south to the Gulf of St. Lawrence (Magdalen Islands), southern Quebec (Point de Monts), southern Mackenzie (Great Slave Lake), southern Yukon (Pelly Lakes and Lake Tagish), and southeastern Alaska (Taku Inlet). The coasts and islands of Bering Sea south to the Aleutian and Commander Islands. North to the Arctic coasts of North America and in the Arctic Archipelago north to 82° north latitude in King Oscar Land, Grant Land, and northern Greenland. In the Eastern Hemisphere, north to 82° north latitude. South in Europe to 50° north latitude; and in Asia to 52° north latitude.

Breeding grounds protected in the following national reservations: In Alaska, Aleutian Islands, as Amchitka, Near Islands, Range Island, Semichi.

Winter range.—Antarctic Ocean, south to 74° south latitude, Weddell Sea, and probably Ross's Sea (off Victoria Land, 76° 52′ S). Northern limit of winter range unknown.

Spring migration.—Northward along both coasts, often well out at sea. Early dates of arrival: Massachusetts, March 20 to 31; Davis Strait, 66° north, April 12; Wellington Channel, June 13; Greenland, 81° 30′ north, June 16; Washington, Crescent Lake, April 15; Alaska, St. Michael, April 25 to May 16, and Demarcation Point, May 31.

Fall migration.—Southward over same routes. Early dates of arrival: California, Point Pinos, August 4; Peru, Santa Lucia, September 19; Chile, Arica, October 4; Argentina, Mar del Plata, October 21. Late dates of departure: Greenland, 81° 30′ north, August 26, and Disco, September 5; Wellington Channel, August 29; Franklin, Winter Harbor, September 5; Keewatin, York Factory, August 28; Ungava, Koksoak River, September 15; New York, Saratoga, October 8; Massachusetts, Cape Cod, October 24 to November 9; Alaska, Point Barrow, September 9; British Columbia, Okanagan Landing, October.

Casual records.—Accidental in the interior, where records are none too well established. Wisconsin records (Lake Koshkonong, breeding, June 1891; Kelley Brook, September 21, 1897, and Milton, May 27, 1899) seem to be authentic. Recorded twice in Hawaii (May 9, 1891, and April 30, 1902).

Egg dates.—Northern Mackenzie: Thirty-two records, June 14 to July 16; sixteen records, June 23 to July 5. Maine and Nova Scotia: Twenty-six records, June 8 to July 21; thirteen records, June 15 to 23. Alaska: Twenty-two records, May 4 to July 1; eleven records, June 14 to 27.

STERNA DOUGALLI Montagu.

ROSEATE TERN.

HABITS.

I shall never forget the thrill of pleasure I experienced when I held in my hand, for the first time, a freshly killed roseate tern and admired with deepest reverence the delicate refinement of one of nature's loveliest productions. The softest colors of the summer sky were reflected on its back and pointed wings, while its breast glowed with the faint blush of some rare seashell. The graceful outlines, the spotless purity of its delicate plumage, and the long tapering tail feathers made it seem like some ethereal spirit of the heavens which it was sacrilege for human hands to touch.

Having been always intimately associated on our Atlantic coast with the common tern, it has suffered with that species in the persecution inflicted on these birds by hunters for the millinery trade. It was everywhere threatened with extermination, and became extirpated in many localities until its range was much restricted. It formerly bred as far east as Maine, and even Nova Scotia, as recently as in 1912, but I believe it is no longer common north of Cape Cod. It seems to have disappeared soon after 1890 from the coasts of New Jersey and Virginia, where it was once abundant. It has profited, however, from the protection afforded the terns in favored localities, and is now increasing on the Massachusetts coast and elsewhere.

Spring.—Audubon (1840) first saw this species in the Florida Keys, where he was told that it arrives about the 10th of April. Baird, Brewer, and Ridgway (1884) give the following interesting account of its arrival on Faulkner's Island in Long Island Sound:

> It makes its appearance about the 15th of May, seldom varying three days from this date. At first six or eight of these birds are seen well up in the air. These hover over the island a while and then disappear. The next day the same individuals return, with an addition of 12 or more to their number; but none of them alight on the island until the third or fourth day. After this, if nothing disturbs them, their number increases very fast.

Its arrival on Muskeget Island, Massachusetts, is thus described by Mr. George H. Mackay (1895):

> As far as I am aware *Sterna hirundo* and *S. dougalli* first make their appearance in Muskeget waters any time after the first week in May, and they are remarkably constant in the time of appearing. In 1892 they arrived on May 10, in flocks of fifty or more, drifting sideways before a heavy southeast rainstorm. In 1893 they arrived on May 8, with light air from the west-northwest and clear weather. Twenty were first observed hovering over South Point, Muskeget Island, very high in the air. About 5 o'clock p. m. two were observed to come quite low down. The next day they were arriving in considerable numbers, flying high during the day time and settling down after sunset. The

Muskeget Island, Massachusetts. A. C. Bent.

Muskeget Island, Massachusetts. A. C. Bent.

ROSEATE TERN.

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weather was clear, with a light southwest wind. On the 10th, at sunrise, the Wilson's and roseate terns were rising in very large numbers from the northern-middle part of Muskeget proper, the weather being clear, with a strong southwest wind. On the 11th they continued to increase. There was a strong southwest gale during the night, dying out in the forenoon.

Courtship.—During the last week in May, while the countless hordes of terns are gathering on these breeding grounds, the roseate terns may be seen flying about in pairs or chasing each other in the air, with their long slender tail feathers streaming behind; or, in the dense flocks, resting and sunning themselves on the beach, their simple courtship may be seen. Both birds show their interest in each other by stretching their necks upward and strutting about with drooping wings and elevated tails; or standing side by side they exchange greetings. Finally the accepted suitor mounts his mate and stands squarely upon her back for a long time, with frequent interlocking of bills. The nuptial caress is most deliberate; and after it is over they stand close together, billing and cooing and preening each other's plumage.

Nesting.—The finest breeding colonies of roseate terns, so far as I know, are at Chatham and on Muskeget Island, Massachusetts. The most important of these is on Muskeget Island, a low sandy island lying between Nantucket and Marthas Vineyard, which has been more fully described under the common tern. On my various visits to this island I have always found roseate terns nesting here abundantly, although they have always been far outnumbered by the common tern. The nests of the common tern were scattered in various situations all over the island, and occasionally a few nests of roseate terns were found among them, but the main stronghold of the roseate terns was on the southern extremity of the island, separated from the main island by a long, narrow beach; here, except for a few scattering pairs of common terns, the whole population was made up of roseates. We determined this fact to our own satisfaction by trapping nine of the birds on their nests in snares made of very fine steel wire. This usually did not injure the birds at all, as we soon released them. The nests were closely congregated on the highest part of the point, particularly along the crest of a little ridge which rose abruptly from the beach. They were mostly well concealed in the thick growth of tall beach grass (*Ammophila arundinacea*), which grew luxuriantly at this end of the island. Some of the nests were hidden among the poison-ivy vines (*Rhus radicans*), or under the shade of herbaceous plants. Often the nests were arched over with the tall grass, having pathways leading to them, and almost always they were more or less under cover, in marked contrast to the nests of the common tern, which were always in open places. In many cases the eggs were laid on the bare sand, but generally a scanty nest was formed by scraping together a few pieces of dry grass or rubbish to partially line a slight hollow in the sand. The method we employed for identifying the nests is the only sure way in a locality like this; it is seldom possible to see one of the birds sitting on its nest; for, as Mr. Mackay (1895) says:

> The alarm is given from bird to bird until it reaches those at the farthest end, who hasten to lend their vocal aid in driving off their common enemy, thus rendering it impossible to come to any conclusion regarding any particular nest and eggs. I have had roseates dart down at me and show every demonstration of anger and solicitude when I have been examining a Wilson's tern's nest and eggs, the identification of which I felt sure. I have also had the same experience with Wilson's tern as the assailant when I have been busy over a roseate's nest and eggs. It must not therefore always be assumed that the solicitous bird is the owner. As far as my observation shows I should say that not only do roseate and Wilson's terns lay their eggs indiscriminately at times in each other's nests, but also care for each other's young and make united battle against intruders.

On Penikese and Weepecket Islands the roseate terns nest mostly in the beach grass, poison ivy, and rank herbage on the higher parts of the islands, where their nests are well hidden. In the summer of 1915 I visited a large and populous colony, consisting of many thousand pairs of common and roseate terns, which had recently been established near the extremity of Nauset Beach, on the mainland of Cape Cod, near Chatham, Mass. This is probably an overflow from the Muskeget colony. Here the roseate terns were nesting under similar conditions to those noted on Muskeget, mainly on the ridges or sand dunes heavily overgrown with beach grass, but surrounded by common terns nesting in the open. On Faulkner's Island, in Long Island Sound, Baird, Brewer, and Ridgway (1884) say:

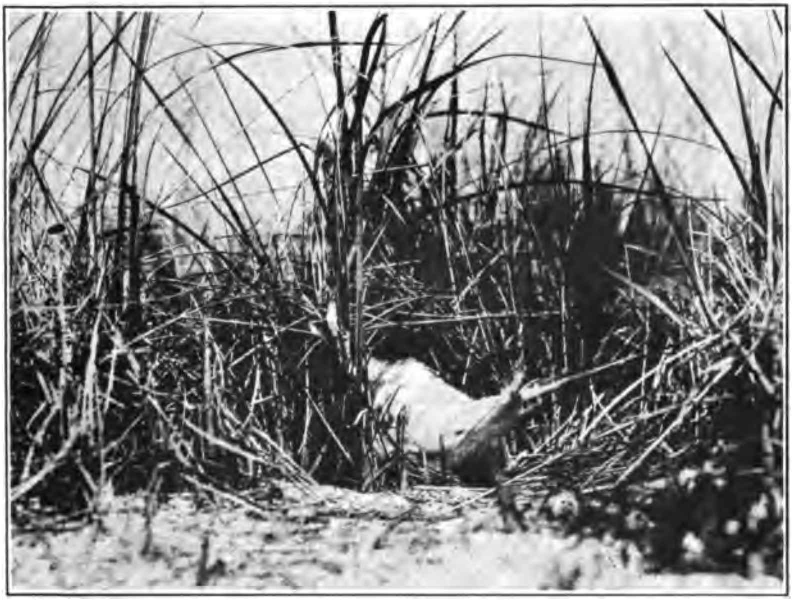
> While some gather a few dry weeds or a little dry seaweed, others make only a hollow in the sand; and some deposit their eggs on the stones without any nest at all.

Audubon (1840) found them breeding in considerable numbers along the shores of southern Florida. He writes:

> At different times in the course of nearly three months which I spent among the keys I saw flocks of 20, 30, or more pairs, breeding on small detached rocky islands, scantily furnished with grass, and in the company of hundreds of Sandwich terns. The two species appeared to agree well together, and their nests were intermingled. The full number of eggs of the present species is three. * * * They were deposited on the bare rocks, among the roots of the grasses, and left in fair weather to the heat of the sun. Like those of the common tern and other species they are delicious eating. The eggs of the Sandwich tern were more attended to during the day, but toward night both species sat on their eggs.

In the Bahamas and West Indies they seem to nest in open situations, with Cabot's and Sooty terns, laying their eggs in hollows

Muskeget Island, Massachusetts. A. C. Bent



Muskeget Island, Massachusetts. A. C. Bent.

ROSEATE TERN.

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in the sand, on bare ground, or on rocks without any attempt at concealment or at nest building.

Eggs.—Some observers suggest that the roseate and common terns raise two broods in a season; fresh eggs are often found late in August, but these are probably laid by birds that have failed to raise their first broods. The usual set consists of two eggs; three are frequently found in a nest and rarely four. The larger sets often, though not always, show evidence of having been deposited by more than one bird.

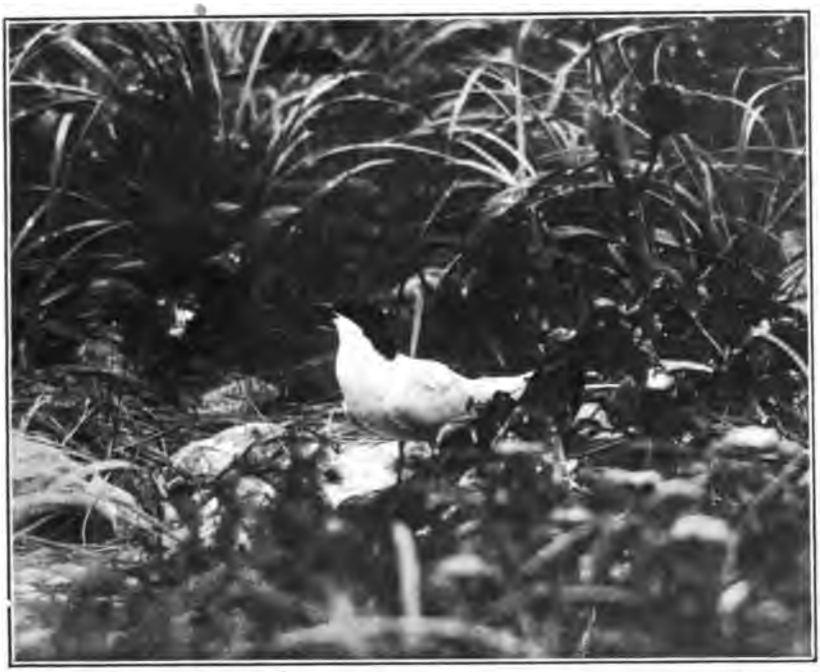
The eggs of the roseate tern are similar to, and often indistinguishable from, those of the other small terns; but when a large series is compared with others the average difference is well marked. They will average a trifle longer and the markings are smaller and more evenly distributed, with fewer of the large bold markings when compared with a series of eggs of the common tern. There is less variation in the ground color, which ranges from "cream buff" to "cartridge buff" or "pale olive buff." The darker and richer colors of other terns' eggs are seldom, if ever, seen in this species. A majority of the eggs are evenly sprinkled with small spots or dots over the entire surface, either with or without an occasional larger spot; these spots are seldom large enough to be called blotches and never as large and conspicuous as they are on the eggs of the common tern. These markings are in the darker shades of brown from "warm sepia" to "dark clove brown." There are often numerous spots of various shades of violet, plumbeous or lavender gray, underlying the darker markings. In shape the eggs vary from ovate to elongate ovate, usually quite pointed. The shell is smooth, thin, and without luster. The measurements of 87 eggs, in the United States National Museum, average 42 by 30 millimeters; the eggs showing the four extremes measure 45.5 by 31, 43.5 by 32, 38 by 30, and 44 by 27.5 millimeters.

The exact period of incubation was found to be 21 days by Prof. Lynds Jones (1906), who has also given us (1903) a good account of the process, as follows:

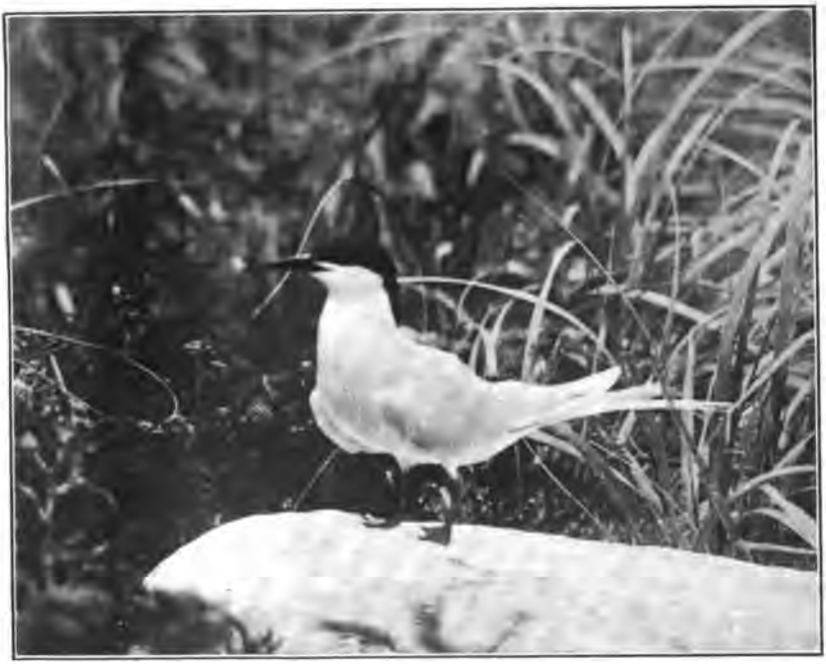
> In two cases that were under careful observation for some time both parents performed the office of incubation in regular turn. The one that I judged to be the female brooded the eggs, tucking them carefully under her feathers, but the male merely stood above them, apparently shielding them from the burning sun, while the female went for a lunch and bath. The incoming bird uttered a peculiar rattling sound just before alighting some 20 feet from the nest, when the brooding bird got up and immediately flew away. The relief carelessly sauntered toward the nest, made believe picking up food when it reached the nest, then stood over it a moment before settling down, if the female. Neither bird remained on the nest over an hour; the male usually less than 40 minutes, not waiting for the female to appear every time before leaving.

Young.—In the same paper Mr. Jones gives us the results of his observations on the behavior of the young terns in the following words:

> There is no uniformity in the development of the instinct to assume protective attitudes. With some young there is no evidence of such an instinct while they remain in the nest, while with others there seems to be almost as soon as the shell is cast. All of the young from the beginning of the pinfeathers gave evidence of the instinct well developed. Some young left the nest two days after hatching; some remained for four days. When partly feathered birds on the uplands were taken from their hiding places in the grass or bushes their tendency was to try to run away instead of hiding again when replaced on the ground. Those on the beach treated the same way would invariably take to the water if not prevented. Even the young upon which the pinfeathers were barely showing frequently took to the water and swam readily. In hiding the birds were content to emulate the ostrich, hiding only the head and often leaving the whole body exposed. They were always careful, however, to keep the white underparts well concealed.
>
> Unlike the gulls. the terns do not swallow the food and then regurgitate for the young, but carry the fish in the beak directly to the young. After studying the feeding process at close range for some time I became convinced that the old birds do not stuff the fish down the throat of the young, but only thrust its head into the mouth far enough for the throat muscles to grip it, when the young bird swallows for himself. The sand launce (*Ammodytes americanus*) was the chief fish food, probably because it is so soft and easily digested. A 4-inch fish could not manage to get wholly inside a 4-inch bird, so the tail was left sticking out for future consumption. Even with the young able to fly the fish's head rested in the primitive gizzard, while the tail was scarcely more than concealed in the throat. Mr. Field induced one Muskeget young common tern to part with his dinner of two young herrings and one sand launce. Usually but a single fish was found in the digestive tract of the young.
>
> The downy young merely raised their heads and opened their mouths for food, when very hungry uttering a faint peep, but the young ones able to fly were made to dance for their dinner. With widely gaping mouth and wings held akimbo, they executed a surprisingly fine clog to their own piercing music. In one case a young bird called for lunch just 20 minutes after receiving a good-sized fish. He was not fed, however, until half an hour after his last lunch. I have repeatedly seen the old birds swallow three and four sand launces in rapid succession. This colony of 1,500 old birds and their 1,500 young must consume great quantities of the sand launce, yet the supply does not seem to diminish.
>
> It was interesting to watch the old birds come in with a fish dangling from the beak. As it passed close along the beach each young bird in turn clamored for the morsel. When the old bird approached the place where its young had been last seen it skimmed above the stones, halting now and then before a particularly vociferous youngster, then either passed on or circled back to look farther; finally either finding its own young or going to another place where another young had been left. I was eager to know how the old birds could recognize their own offspring among the multitude which looked exactly alike to me. It seemed incredible that they depended upon sight, or why should they almost actually touch the young each time before deciding the matter? I was forced to the conclusion that the sense of smell must play an important part in the final determination.



Weepecket Island, Massachusetts. A. C. Bent.



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Later in the season young birds were seen following the old birds to where they fished, all the while loudly calling for food. I was prepared to see the morsel delivered while the birds were still flying, after the manner of the swallow, but it was never so done. The young, at least, must first rest upon the water or land, then the old usually settled for the moment of the delivery, the young bird, first shaking his feathers well before rising and following. During the second week in August young birds were to be seen and heard about Great Harbor and Penzance, but none appeared to be fishing for themselves. Up to this time, there appeared no evidence that either the old or young had begun to molt.

Plumages.—The downy young of the roseate tern can be readily distinguished from the young of the other species, with which it is associated, by certain well-marked characters. Its general appearance is more grizzly, more finely and evenly sprinkled with smaller spots, whereas the young common and arctic terns are more boldly spotted with a more conspicuous pattern. The texture of the down is more hair-like, particularly on the heads, necks, and throats of the younger birds. In this respect and in the texture of the down on the back there is a striking resemblance to the young chick of the royal tern. In the newly hatched chick the downy feathers of the back and wings stand out separately, round and fluffy at the base, but tapering to a fine point at the tip. There are at least two distinct color phases in the downy young, brown and gray; in the brown phase the color varies from "pinkish buff" or "cream buff" in the youngest birds, to "cinnamon buff" or "chamois" in older birds; in the gray phase the color varies from "pallid neutral gray" to "pale neutral gray"; in both phases the upper parts, including the throat, sides of the neck, and flanks, are uniformly and thickly spotted with small spots of "dark neutral gray" or dull black. Only the central under parts are white. The dusky throat of the young common tern is replaced by a pale grayish area or one uniform in color with the upper parts. Another distinctive character is the color of the feet; whereas in young common and arctic terns these are in light shades of flesh color, reddish, or orange, in the young roseate they are much darker, "russet vinaceous" in the youngest, to "sorghum brown" or "Hay's brown" in older birds, and finally darkening to dull black in large downies and juvenals.

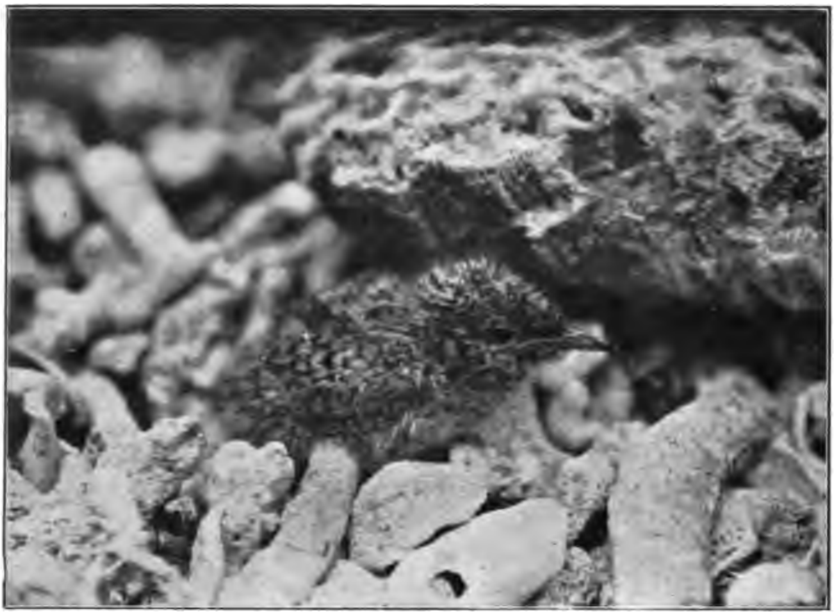
The first plumage appears on the scapulars when the young bird is half grown. In the brown phase this is a rich "clay color"; in the gray phase it is pale buff. The wings are the next to become feathered. The juvenal, or first, plumage is unlike that of the common tern; it is more boldly and conspicuously marked with black and white; the feathers of the back, scapulars, and tertials are subterminally barred with brownish black or heavily marked with U-shaped or V-shaped spots of the same; the scapulars and tertials have several such markings or a variegated pattern of them. When the plumage is fresh these feathers are broadly margined or tipped with "pinkish buff," but this color fades out to white. Often these buffy areas are finely sprinkled with dusky; the outer tail feather on each side is unmarked, but the others are more or less dusky near the tips. In the juvenal plumage young roseate terns have faintly rosy breasts and black or blackish feet, whereas in young common terns the breasts are white and the feet pale flesh color or dull reddish. The change into the first winter plumage, early in the fall, is accomplished by a partial molt of the body feathers. Early in the spring a complete prenuptial molt takes place, at which all of the mottled feathers disappear, the black cap is assumed, and most young birds become indistinguishable from adults. I have never seen a "*portlandica*" plumage in this species.

Adults have a complete postnuptial molt in August and September, or later, at which the adult winter plumage is acquired; the rosy breast is replaced by white and the white forehead is assumed. They also have a complete prenuptial molt in the early spring which produces the full nuptial plumage.

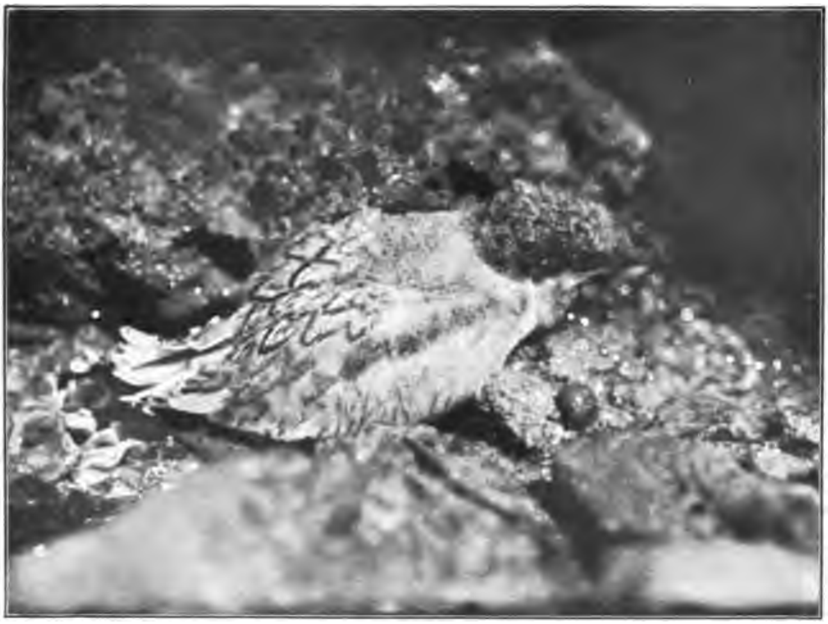
Food.—In the swift tide rips about the sandy shoals, where the voracious bluefish drive the small fry to the surface in great schools, the terns find a fruitful feeding ground, for the little fish in their attempts to escape from their enemies below only betray themselves to the hungry birds above as they huddle together and skip along the surface in their fright. Here the terns gather in excited throngs and turn the tables by showing the fishermen where to troll for bluefish. In return the fishermen shoot the birds for their plumage or rob them of their eggs. So the struggle for existence goes on, and the weakest individual—in this case the tiny minnow—always gets the worst of it, for at best he can only "jump from the frying pan into the fire." Mr. William Brewster (1879) has well described it as follows:

> It is an interesting sight to watch the birds collect. A moment before perhaps only a few were to be seen, leisurely winnowing their way along the shore; but in an incredibly short space of time the lucky discoverer of a school is surrounded by hundreds of his fellows, and a perfect swarm of eager, hungry birds poises over the spot. Dozens dash down at once, cleaving the water like darts, and, rising again into the air, shake the salt spray from their feathers by a single energetic movement, and make ready for a fresh plunge. Every bird among them is screaming his shrillest, and the excitement waxes fast and furious. Beneath, the bluefish are making the water boil by their savage rushes, and there is fun and profit for all save the unfortunate prey.

The food of the roseate tern consists almost wholly of small fishes, but Audubon (1840) found them feeding also on "a kind of small molluscous animal which floats near the surface, and bears the name



Dry Tortugas, Florida. Paul Bartsch.



Dry Tortugas, Florida. Paul Bartsch.

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of 'sailor's button.'" Professor Jones (1903) identified the following species of fishes dropped on their breeding grounds:

> Sand launce (*Ammodytes americanus*), cunner (*Tautogolabrus adsperus*), mullet (*Mugil curema*), pollock (*Pollachius virens*), flounder (*Pseudopleuronectes americanus*), and young herring (species not determined). Of all the food the sand launce comprised not less than 80 per cent.

Behavior.—The flight of the roseate tern is exceedingly light and graceful; it is the greyhound of its tribe, the longest, slenderest, and most highly specialized of the terns. As it floats along, with its long tail feathers streaming out behind, it seems to cleave the air with the greatest ease and swiftness, like a slender-pointed arrow. Its downward plunges into the water for its prey are swift and accurate; it often goes beneath the surface and generally emerges with a tiny minnow in its bill. Its shape and movements will generally serve to identify it, and if near enough, its black bill is a good field mark.

Its voice, however, is the surest means of identification, for it is entirely unlike that of the other terns with which it associates. Its alarm note seems entirely out of keeping with its grace and beauty of form and color, for it is harsh and grating, a prolonged rasping cry, like the syllables "kreck" or "crack" or "kraak," louder and on a lower key than the cries of other terns. Mr. Brewster (1879) has likened this note of excitement or anger to the sound made "by forcibly tearing a strong piece of cotton cloth." He also observes that its usual note is "a soft mellow hew-it, repeated at frequent intervals," which I have recorded in my notes as "kulick," a musical note heard on its breeding grounds when undisturbed. This is usually in soft conversational tones, mingled with a variety of cackling, chattering, and gurgling notes.

The roseate tern is intimately associated on its breeding grounds with the common tern, the laughing gull, the Cabot's tern, and the sooty tern in different portions of its range, all of which species seem to live with it in reasonable peace and harmony. It is generally a peaceful and harmless neighbor, even friendly and sympathetic at times in helping to care for the young of others. At other times it seems to be very pugnacious, attacking and severely mauling a strange young one which wanders too near its own young, or quarreling with other adults of its own or other species. On Muskeget its chief enemy used to be the short-eared owl, a pair of which lived on the island and raised havoc among the terns; the owls were finally killed, however, in the cause of bird protection. Cats have been brought to the island, where they did so much damage that they, too, were removed. Marsh hawks and crows occasionally visit the islands and probably kill some young terns.

Fall.—By the first or middle of August, when the young birds have been taught to fly and fish for themselves, both old and young birds begin to move away from their breeding grounds and wander about the coasts and islands in search of food, often straying far north of their breeding haunts at this season. They often congregate in large flocks, following the schools of small fish, resting and roosting on the sand beaches and sand bars. Their time for departure for the south depends on the food supply, but they usually begin to disappear in October and before the end of the month are all gone. They are said to follow the schools of bluefish, or, at least, to disappear with them. Their fall migration carries them beyond the limits of the United States to their winter quarters in the Bahamas, the West Indies, and the coasts of South America.

DISTRIBUTION.

Breeding range.—In North America, along the Atlantic coast from Nova Scotia (Sable and Noddy Islands) locally to New York (Long Island and vicinity); Florida (Tortugas); formerly in New Jersey and Virginia. Bermuda and Bahama Islands (Acklin, Eleuthera, etc.), the Lesser Antilles (Antigua, Guadeloupe, Dominica, Grenada, etc.), and westward to Venezuela (Aruba Island) and British Honduras. In the Eastern Hemisphere on the coasts of the North Sea and Atlantic Ocean from 57° north latitude to the Mediterranean, the Azores, Madeira, the coasts of Africa, Madagascar, Ceylon, and southern China. The Australian bird has been described as a distinct subspecies.

Breeding grounds protected in the following national reservation: In Florida, Tortugas Islands.

Winter range.—From the Bahama Islands, Cuba, and occasionally Louisiana, southward to Brazil; and from southern Mexico (Tehuantepec) to Chile.

Spring migration.—Arrives in Bermuda from April 29 to May 1; Massachusetts, Muskeget, May 8 to 10; Connecticut, Faulkner's Island, May 15.

Fall migration.—Leaves Bermuda in September and Massachusetts about October 1. Other migration data seems to be lacking; probably the migration occurs well off the coast.

Casual records.—Accidental inland as far north as New York (Youngstown, May 31, 1886) and as far west as Indiana (Millers, August 14, 1916).

Egg dates.—Massachusetts: Thirty-one records, June 2 to August 15; sixteen records, June 15 to July 6. Bahamas and Florida Keys: Eight records, April 30 to June 12; four records, May 16 to 21.

STERNA ALEUTICA Baird.

ALEUTIAN TERN.

HABITS.

The type specimen of this unique species was secured by Bischoff. on Kodiak Island, on June 12, 1868, together with a single egg. It has apparently not been found breeding there since and has not even been seen there in recent years. The name Aleutian tern is a misnomer, based on an erroneous theory that it would be found breeding among those islands; but none of the various explorers who have visited that region have succeeded in finding it. It was not heard of again until Mr. L. M. Turner (1886) found it breeding near St. Michael, Alaska, in 1875 and 1876. Dr. E. W. Nelson (1887) was still more successful in adding to our knowledge of this rare species. During his "residence at St. Michael he found these birds to be regular and common summer residents in certain restricted localities where they nested. They extend their range to the head of Norton Bay, and also reach the Siberian coast of Bering Straits, as shown by their presence in St. Lawrence Bay, where Mr. R. L. Newcomb, naturalist of the *Jeannette*, found them in 1879." Practically nothing has been added since that time to our meager knowledge of the habits and distribution of this rare species, which seemed to have such a restricted habitat. Col. John E. Thayer has recently shown me 11 specimens of Aleutian terns collected on Sakhalin Island, on the east coast of Siberia, on June 23 and 24, 1914, which were probably breeding birds. This tends to confirm a theory which I have long held that the Aleutian tern is an Asiatic species which has extended its breeding range across Bering Straits, as several other species have done, and become temporarily or permanently established at a few isolated spots on the Alaskan coast. The Kodiak colony was evidently unsuccessful, but the two colonies near St. Michael have persisted up to the present day (1915) as permanent outposts, one containing about 20 pairs and one about 40 pairs of breeding birds.

Spring.—According to Doctor Nelson (1887), the Aleutian terns

> reach St. Michael from May 20 to 30, rarely earlier than the first date, and are found scattered along the coast, in company with the Arctic tern, for a short time, but early in June they gather about the islands where they nest. One of these islands is about a mile from St. Michael, in the mouth of a tide channel known as the "canal." This island is nearly half a mile across, rises about 30 feet from the beach in a sharp incline, and has a rather level top, covered with a thick mat of grass, moss, and other vegetation. The upland is dry, and here the birds breed, laying their eggs directly upon the moss, with no attempt at a lining, which would be entirely unnecessary there. Some 18 miles to the eastward, along the coast, and less than a mile from the Eskimo village of Kegikhtowik, is another island in a bay, presenting almost the same character-

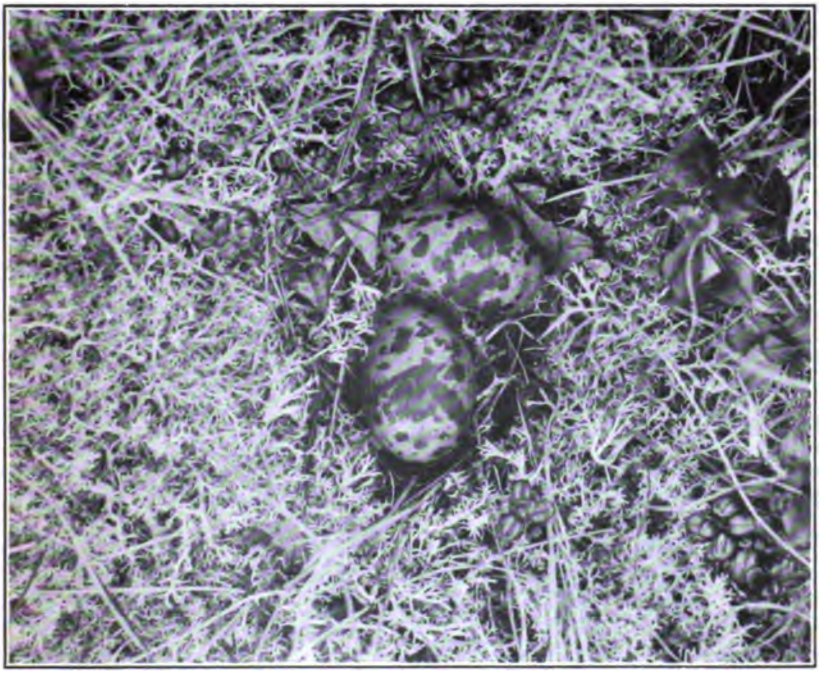
istics as the one first described, and upon the higher portions the birds nest even more commonly, for, as against the 20 pairs or so nesting on the first island, some 30 or 40 pairs occupied the latter island both seasons when it was visited by the writer. From the proximity of native villages, and owing to the persecution received at the hands of Turner and myself, the birds on these islands were very shy, and it was no easy task to secure specimens.

Nesting.—While passing through St. Michael on July 8, 1914, my assistant, Mr. Hersey, secured two specimens of Aleutian terns, and again on July 17, 1915, he succeeded in collecting a small series of these interesting birds near the island referred to above. I had sent him there again in 1915 to spend the whole summer in the vicinity of St. Michael. His several visits to the island at the mouth of the canal resulted in his securing several sets of eggs, mostly sets of two, taken on June 23 and 28 and July 3. His notes state:

> The island where the Aleutian terns breed rises rather abruptly from the water to a height of about 25 feet and then spreads out broad and fairly level. At one end are several small ponds, and here it is lower than at other places. The higher parts are covered with a mat of dry grass of last year's growth, through which the new green blades are now appearing. In this matted grass the terns are now nesting, not in a compact colony, but scattered about in single pairs. Although apparently nesting anywhere over this space, the nests are in reality placed rather near the edge of the island, and in most cases the sitting bird could look out over the water. I found no nests in the center of the island. Among this tangle of dry grass are interspersed patches of a soft gray moss which grows close to the ground. These patches vary from 1 or 2 feet in diameter to several yards in size. In these patches of moss the nests are generally made, the small ones being selected as the near-by grass affords some concealment. None were found among the larger patches. One nest was found on a mound of rotten wood, where a log of driftwood had decayed. The nest is a depression in the moss 3 or 4 inches across and about 1½ inches deep, and is unlined. Two eggs appear to complete the set.
>
> While walking over the island the birds circled high overhead, and nothing in their actions disclosed the location of any of their nests. They seldom came very near even when a nest was found, but one pair of birds darted down close to my head as I neared their nest. When I first landed on the island where the terns were nesting the birds began to fly up out of the grass, and by marking the spot from which they rose a nest could generally be found. Although but slightly concealed I found the nest exceedingly hard to find, and it took an average of an hour to locate each one.

Eggs.—Mr. Hersey's experience would seem to indicate that two eggs constitute the normal set; probably three eggs are rarely laid, and occasionally only one. Several sets of three eggs each, collected on Stuart Island by Capt. H. H. Bodfish, are probably eggs of the Arctic tern. Some of these that I have seen do not show any of the well-marked characteristics of Aleutian tern's eggs. Moreover, Mr. Hersey, who spent considerable time on Stuart Island, says that it is not at all suited for the breeding requirements of the Aleutian tern, and that none breed there, though the Arctic tern does breed there.

St. Michael, Alaska. F. S. Hersey.



St. Michael, Alaska. F. S. Hersey.

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I believe that the series of eggs collected by Mr. Hersey are the only authentic eggs of the Aleutian tern in existence outside of those collected for the United States National Museum referred to above. These eggs vary in shape from ovate to elongate ovate, with a decided tendency toward the latter. The shell is thin, with very little luster. The ground color varies from "clay color" or "honey yellow" to "olive buff" or "Marguerite yellow." In a general way, they are not only more elongated, but darker and more richly colored than other tern's eggs. They are usually heavily marked with large blotches and smaller spots, scattered irregularly over the egg or coalesced into longitudinal splashes or in a wreath near the larger end. These markings consist of underlying spots or splashes of various shades of drab, from "deep brownish drab" to "pallid brownish drab," overlaid with bold and handsome blotches and spots of the darker and richer shades of brown, such as "Mars brown," "Vandyke brown," and "light seal brown." The measurements of 44 eggs, in the United States National Museum and the writer's collections, average 42 by 29 millimeters; the eggs showing the four extremes measure **46.7** by 30, 45 by **30.5**, and **40** by **27.5** millimeters.

Young.—Only one brood is raised in a season, and, according to Mr. Hersey's experience, no second attempt to raise a brood is made if the first eggs are taken. Mr. Turner (1886) gives the period of incubation as 17 days, but this is evidently an error, as the common and roseate terns are known to have an incubation period of 21 days. Doctor Nelson (1887) says:

> The eggs are rarely laid before June 5 or 10, and I found one egg with an embryo two-third grown on September 1, but this is very unusual. The young of *aleutica* are hatched from the last of June until September, and the first ones are on the wing by the last of July.

Speaking of the second island, referred to above, near St. Michael, he writes:

> On September 1, 1879, I visited the island near Kegikhtowik and found from 60 to 80 adults of this species haunting the vicinity and circling in graceful flight all about the island. When we landed and passed over the island the birds showed considerable anxiety and continually uttered a thin, clear, thrilling whistle. With the exception of some broken eggshells and the old depressions showing the nesting sites, nothing but a single egg was found there; but as we walked out on a low cape, covered with large scattered rocks, we put up, one after the other, a considerable number of young birds just able to fly, and a goodly number were secured. When they arose they had a queer, erratic, dazed kind of flight, reminding me of the flight of an owl suddenly disturbed in the daytime. The old birds kept flying in toward the point with small fishes in their beaks, but although we concealed ourselves in the rocks others of the party evidently warned them, so that only two or three of the adults were taken. One young bird was fired at and missed and flew wildly out to sea, when it was joined by an old bird, which kept close to it, and as the young bird

became tired and turned toward shore the parent met it and forced it to turn back. This maneuver was repeated over a dozen times, until the young bird was forced off to sea out of sight. This was one of the most striking instances of bird sagacity I met with in the north.

Plumages.—Doctor Nelson (1887) describes the downy young as follows:

> The downy young of this species appear to be distinguishable from the young of all other species. The color above is a grayish buff profusely blotched with black. The black of the chin and throat extends somewhat to the upper portion of the breast. The breast is pure white, shading into a very dark gray on the belly and sides. There is considerable difference in individual specimens, some being of a light buff above. As compared with the downy young of *paradisaea* from Labrador, these birds are darker above, buff instead of a light fulvous, and with more black blotching. The black of the under parts in *paradisaea* is limited to the chin and throat, while the belly is of a much lighter color.

He says further:

> The young in any stage may be readily distinguished from the young of *paradisaea* by the deeply cleft toe-web, whereas the web of the latter is nearly full.

August birds, in fresh juvenal plumage, have the crown "fawn color" or "wood brown" mottled with blackish, more thickly posteriorly; the sides of the neck and chest are washed with paler shades of the same; the feathers of the back, scapulars, and lesser wing-coverts are dark "sepia," broadly edged with "cinnamon buff," which is most conspicuous and brightest on the larger scapulars; the secondaries are broadly tipped with white, making a conspicuous wing band; the rump is ashy, not white, as in the Arctic tern; the tail feathers are broadly tipped with "cinnamon buff" beyond a subterminal dusky area; the under parts are white. These colors become paler with age and probably the buff edgings fade out to white or wear away during the fall.

Unfortunately we have no material for study in our collections which illustrates anything but the juvenal and the fully adult breeding plumages, so we can only guess at the subsequent molts and plumages. No birds in immature spring plumage have ever been taken on the breeding grounds, which shows that the young birds do not breed during the first spring or that the full plumage is acquired by that time; probably the latter is the case.

Food.—There seems to be no data on the food or feeding habits of the Aleutian tern, but probably it does not differ materially in this respect from the Arctic tern, with which it seems to be intimately associated.

Behavior.—Regarding the appearance of the Aleutian tern in life, Mr. Hersey says that it can be distinguished from the Arctic tern by its darker color, the under parts, including the wing linings, appearing lead-colored. The white forehead is seldom noticeable in flight, except at short range, when the black bill and black feet can be seen. The body appears to be heavier, the wing strokes slower, and the whole bird larger. It habitually flies at a higher elevation above the ground or water, usually above gun range. A wounded bird gives the characteristic, harsh tern cries which serves to draw its companions down nearer the ground. The birds thus attracted seldom hover over their fallen comrade, but swoop down near him, then pass and mount upward again.

Mr. Turner (1886) says:

> The note of this bird differs from that of *S. paradisaea* in that the "squay" is weaker and squeaky. The other note is like *twe-e-e-e* prolonged, and is really distinguishable from the harsher "squay" of the *S. paradisaea.*

Mr. Hersey records the ordinary note as a three-syllable whistle, suggesting a shore-bird's call rather than the harsh, grating *tee-ar-r-r* so characteristic of other terns.

After collecting the eggs mentioned above, Mr. Hersey left the terns to lay again and hatch out broods of young, but evidently they did not do so, or, if they did, their plans for rearing young were frustrated by a short-eared owl which he found living on the island; whether the owl had destroyed the young or had so persecuted the old birds that they did not lay again is a question.

Fall.—Not much is known about the fall migration or the winter home of the Aleutian tern. Mr. Nelson (1887) says:

> The old birds stray along the coast after the 1st of July and until about the middle of September, after which none are seen until the following season.

Where they go is a mystery, certainly not down the Pacific coast of North America; probably they retreat to their Asiatic home, whence they extended their range to Alaska and migrate down the coast to Japan, and perhaps much farther south or west.

DISTRIBUTION.

Breeding range.—Known to breed only on two small islands in Norton Sound, Alaska, near St. Michael and near Kegikhtowik. Probably breeds on or near Saghalin Island, in the Sea of Okhotsa, Siberia, where birds were taken in June. Once bred on Kodiak
Winter range.—Unknown. Recorded in northern Japan (off
Island, Alaska.
Yezo).

Spring migration.—Arrives at St. Michael, May 20 to 30.

Fall migration.—Leaves St. Michael about the middle of September.

Eggs dates.—Alaska (St. Michael): Five records, June 23 to 28.

STERNA ANTILLARUM (Lesson).

LEAST TERN.

HABITS.

Clearly impressed upon my mind is a vivid picture of a peaceful summer scene in a remote corner of Cape Cod; a broad, flat sandy point stretched for a mile or more out into the sea; the deep blue ocean with its cooling breezes made a pleasing contrast to the glaring white sands which reflected the heat of the midday sun; scattered about on the sandy plain around me were the little hollows containing the eggs of the least tern, almost invisible among the pebbles, bits of shells, and small stones, which they resembled so closely; and overhead the air was full of the graceful, flitting forms of this little "sea swallow," darting down at me, with sharp cries of anxiety, or soaring far aloft until they were lost to sight in the ethereal blue of a cloudless sky. Such a picture as this was a common sight, in those days, anywhere along the Atlantic coast from Massachusetts to Florida, where the least tern was widely distributed and very abundant in all suitable localities. But its graceful form and delicate plumage was so much in demand for the millinery trade that it was practically extirpated in nearly all places where it was easily accessible, leaving only a delightful memory of a joy that had passed. It was never particularly shy and was easily killed on its breeding grounds, its social and sympathetic habits making it a simple matter to practically annihilate a whole colony in a single season.

Numerous colonies formerly existed on the southern coasts of New England. Mr. William Brewster (1879) wrote that "formerly a small colony of least terns nested annually upon the Ipswich sand hills, but they have been entirely driven away by persecution," but since that time they have not been found breeding north of Cape Cod. Mr. John C. Cahoon (1890) wrote:

> Not a day passes in the summer that the fishermen about this island do not patrol the beach in search of the tern's and piping plover's eggs. The birds have no chance to breed. When I first visited the island about six years ago there were several hundred pairs of least tern breeding, but they have now become reduced to less than 25 pair.

This and other Massachusetts colonies were practically annihilated during the next few years, but a few small colonies have always survived on the south coast of Martha's Vineyard, though they became much reduced in numbers. On the much-frequented beaches, near the summer resorts, the birds were shot and their eggs were picked up by boys; cats undoubtedly did their part in the extermination; and occasionally a whole colony was washed out by an extra high tide. During recent years, since 1905, the least terns have been slowly increasing in Massachusetts; they are now breeding again in

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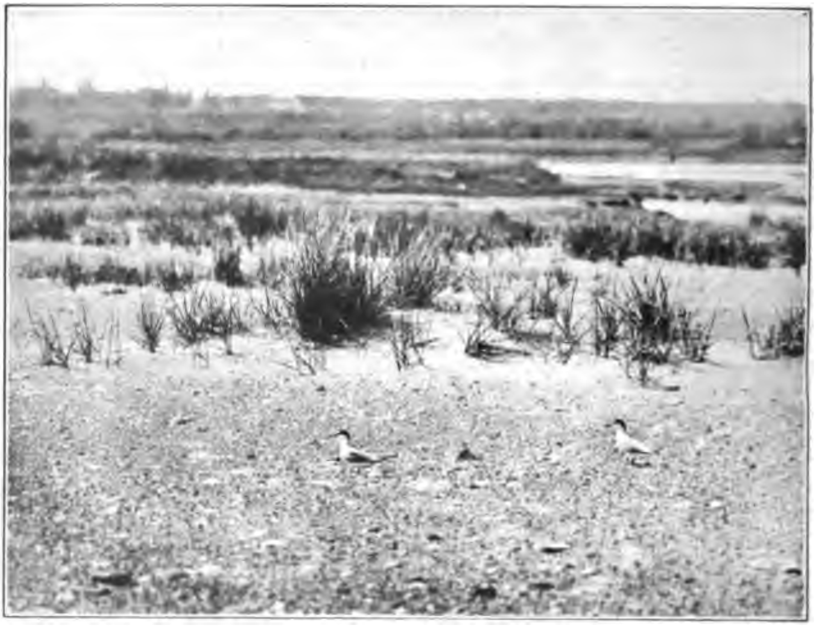
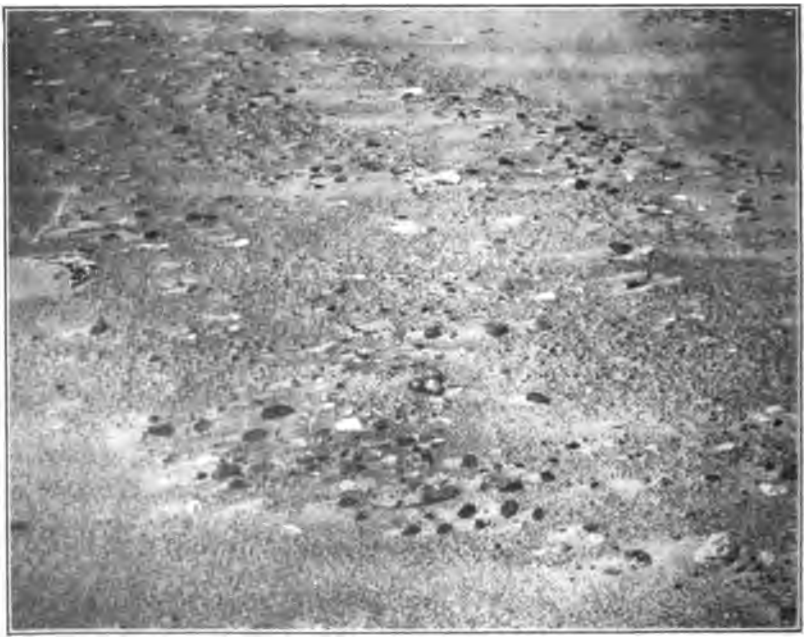


Dartmouth, Massachusetts. A. C. Bent.



Dartmouth, Massachusetts. A. C. Bent.

LEAST TERN.

FOR DESCRIPTION SEE PAGE 336

several places where they had been entirely extirpated, on the mainland as well as on the islands.

In Wilson's time the least terns bred abundantly on the New Jersey coast. During his whole stay on the Cape May beaches they flew in clouds around him. Mr. G. S. Morris says, writing of the same spot in 1881, in some notes sent to Dr. Witmer Stone (1909):

> The least terns bred in considerable numbers. and were equally vociferous in their protests against intruders. It is difficult, at this late date (1909), to give an estimate of numbers, but I can remember standing in one spot and seeing five or six nests within a radius of 15 or 20 feet; but my recollections are that these conditions only pertained to an acre or so of the beach. In the summer of 1884, in July, I could find no least tern's eggs, and natives told me they no longer found eggs on the beach. During the period 1881–1886 I saw a good deal of the slaughter of the birds in this region. I remember coming upon two professional millinery gunners, I think in the summer of 1885, who had two piles about knee-high of least and common terns, which they said they were sending to New York, my recollection being that they got 12 cents apiece for the birds.

Dr. Witmer Stone (1909), writing of the conditions in 1908, says:

> Mr. H. G. Parker in 1888 estimated that there were only 30 pairs left on Seven Mile Beach, and Mr. Philip Laurent (1892) says that some still breed there. Since then we have no definite breeding record, but Mr. W. L. Baily saw two birds together at Stone Harbor, July 15, 1899, which he felt sure were nesting.

Since that time least terns have increased in numbers all along the coast where protected.

The most pitiful tale of destruction is the story of the Cobb's Island and other colonies on the coast of Virginia. Mr. H. B. Bailey (1876), in writing of the nesting habits of the least tern, or "little striker," on Cobb's Island in 1875, says:

> Colonies of about 50 pairs each of this species extend the whole length of the island at about a distance of 1 mile apart.

Least terns were astonishingly abundant all along the Virginia coast at that time, but during the next decade their destruction was appalling. Professional collectors for the millinery trade spent the greater part of the breeding season on the islands and killed the innocent birds in almost incredible numbers. The resident fishermen and oystermen also found it a lucrative occupation. As many as 1,200 birds were often killed in a day, and one of the residents, who had taken part in the slaughter himself, told me that as many as 100,000 terns were sometimes killed in a season. Mr. William H. Fisher (1897), writing of conditions in 1891, says:

> When I first went to the island about 28 years ago the least, common, and Forster's terns nested there in colonies of thousands, but now few of them breed and the least is seldom seen. During four days on the island in May, 1891, I only saw one of the latter, and it was as wild as an oystercatcher, which is a very wild bird. The royal tern also nested on the island at one time.

The least terns disappeared entirely during the next 10 years. Dr. Frank M. Chapman (1903) visited Cobb's Island in 1902 to gather material for his habitat group, and found them entirely gone. He says of their destruction:

> The former captain of the life-saving station told me of 1,400 least terns being killed in one day; while the present captain of the station and Mr. E. B. Cobb, owner of the island, informed me that when terns were first killed for millinery purposes they, with another man, killed 2,800 birds in three days on and near Cobb's Island. The birds were packed in cracked ice and shipped to New York for skinning, 10 cents being paid for each one.

The least terns were reported as increasing again in 1905, but when I visited the island during the height of the breeding season in 1907 I failed to see a single bird of this species.

The colonies on the coasts of North and South Carolina were not completely annihilated, but they were greatly reduced in numbers. Mr. Arthur T. Wayne (1910) says:

> Hunters came from the north with regular outfits to wage war against these poor, defenceless creatures, and in one season alone all of these terns breeding on Bull's Island were killed.

In Florida the same cruel work of destruction was systematically conducted. Mr. W. E. D. Scott (1887) thus describes the methods employed:

> About 4 o'clock this afternoon a "sharpie" schooner, some 45 feet in length, came from the direction of Big Gasparilla Pass and anchored within 200 feet of us. The crew to the number of four at once went on the beach, and from the time they landed until dark there was a perfect fusilade. Going over to see what they were doing I found that they were killing all kinds of shore birds and least terns. One of the men told me that this was Mr. Batty's boat, and that they were collecting birds for the "plume market"; that Mr. Batty was down the beach shooting and would be back for supper. They had bunches of Wilson's plover (breeding), least terns, and various kinds of sandpipers. These birds are skinned, partly filled out with cotton, and at once wrapped up in paper and packed away to be finished after reaching the north. They were killing and preparing by these methods, during the time I was near Mr. Batty's party, from 100 to 150 birds a day. I called on Mr. Batty later in the evening and learned something of his work.

Spring.—Mr. William Brewster (1879) has written the following attractive account of the arrival of the terns on their breeding grounds:

> Spring comes over the sea later than upon the land, and fewer tokens are given of its presence. There is no freshening grass; no budding foliage, nor springing up of green things in sheltered places. Summer may be close at hand, but as yet the sea gives no sign. When the wind is from the north the waves in the bay have that steely glint that they have borne all winter. The sand drifts drearily over the wind-swept beach ridges, and the marshes are black and brown, while in the interior robins may be hopping about upon green lawns and violets blooming in every woodland nook. The ducks and geese, it is true, are marshaling their cohorts and stretching out in long lines

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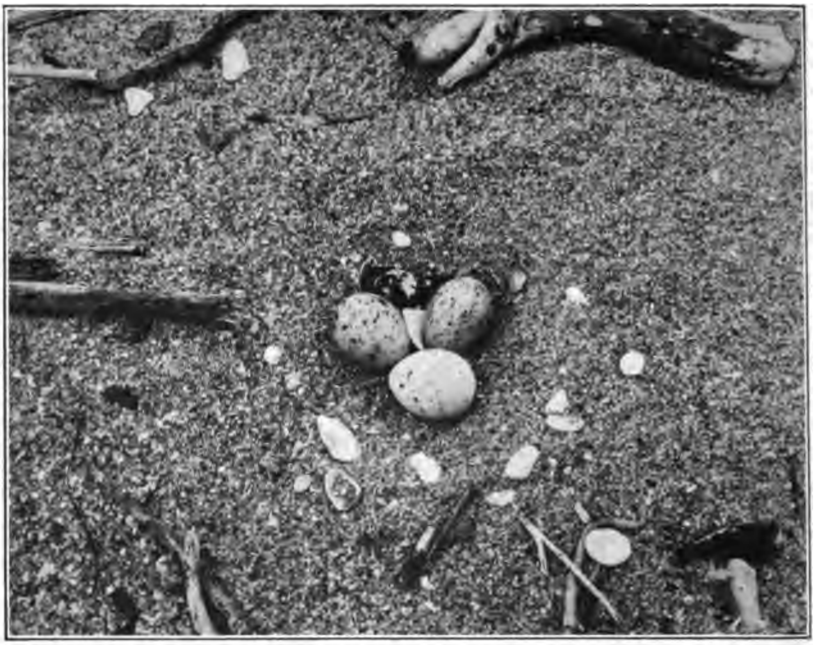
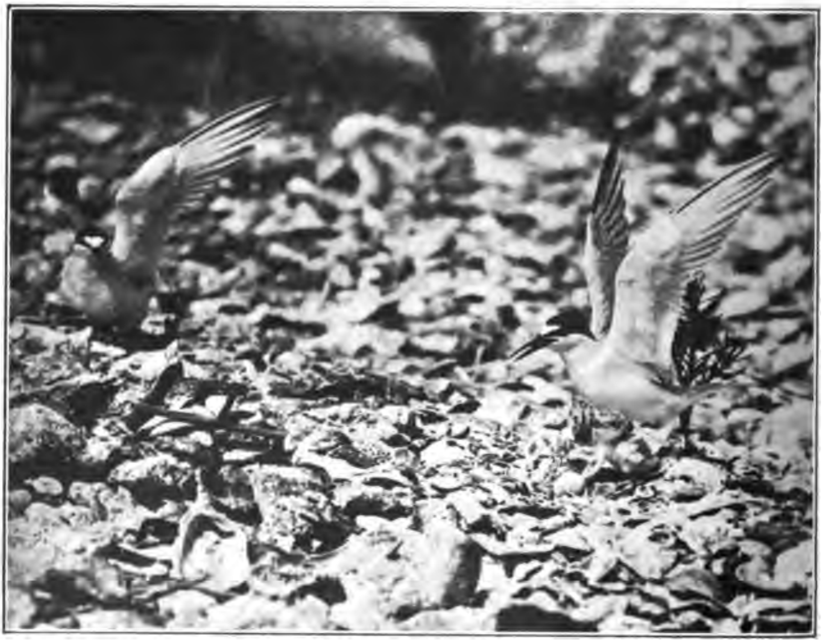


Orange County, California. W. M. Pierce.



Louisiana. **A. M. Bailey.**

LEAST TERN.

FOR DESCRIPTION SEE PAGE 336.

northward, but the breath of ocean is still chill and cold. Indeed, the season is commonly far advanced and the apple orchards in bloom inland ere the winter gulls are gone to their distant breeding grounds. Scarcely has the rear-guard of their legions departed, when the terns begin to appear.

The least terns, although the smallest and seemingly the most delicate of their tribe, arrive first. By the middle of May they appear in certain favored spots—for they are not anywhere very numerous—and small colonies of from 10 to 50 pairs are soon formed at various points along the shores of Cape Cod and upon some of the more sandy islands in the Vineyard Sound.

Nesting.—The localities usually selected by the least tern for nesting are broad, flat, open sand beaches, entirely devoid of vegetation, where there are more or less small stones and bits of shells scattered about, among which the eggs are quite difficult to detect. The eggs are usually laid well above the reach of the ordinary high tides, but occasionally the combination of a heavy gale with the spring tides will result in the washing out of a whole colony. This has occurred several times on the south shore of Marthas Vineyard, where the beaches are low and much exposed. Whereas other terns almost always nest on islands, the least tern frequently breeds on suitable beaches on the mainland if they are not too near human habitations. The depredations of cats, rats, or small boys will drive them away from much frequented beaches.

In the northern portion of its range, at least, these terns usually select a section of beach somewhat apart from other species, though they often associate to some extent with piping plovers. In the Carolinas they are found breeding among or near the common terns and black skimmers. The nest is merely a small hollow scooped in the sand, in which usually two eggs are laid, occasionally three, and very rarely four; the larger numbers are more frequent northward and less so southward.

On May 8, 1903, I found a small breeding colony of least terns on Lake Key, one of the Florida Keys, a low, flat island, with sandy or shelly beaches, frequented by migrating shore birds. Beyond a narrow strip of low mangroves, just above the beach, we came upon a small, shallow, muddy pond, where a small but very noisy colony of black-necked stilts were breeding. The least terns' nests, about 40 of them, were on a narrow strip of beach on the shore of this pond, and consisted of little hollows in the sand, or finely broken shells, of which the beach was composed. Most of the nests contained two eggs, some only one, and those that we collected were all fresh. The nests were strung along in a row a few feet apart. A few pairs of Wilson's plover were breeding on the beaches and among the small mangrove bushes. In the Florida Keys and West Indies the eggs of the least tern are gathered for food. The bird is locally known there by a variety of names, such as "killing peter," "kill-em polly," and "sand peter."

There are a few small breeding colonies of least terns in the reservations on the coast of Louisiana. In the lower Mississippi Valley there are a few colonies breeding on low, sandy islands in the Mississippi and Missouri Rivers, where their nesting is much delayed by high water in the spring. Mr. Gideon Mabbett, who has studied the breeding habits of this species on the sand bars of the Mississippi River, near Rodney, Mississippi, sent to Major Bendire the following notes:

> On their first appearance they are generally resting on an old log or piece of drift-wood floating in the back water of the Mississippi River, and remain very quiet for sometimes for a day or two, as though they were tired from a long flight. In a few days they are here in great numbers, flying around and chasing each other as though making love to each other. As the waters recede they take themselves more to the river proper; when the high places are out of water they then prepare the nest, which is nothing more than a small depression scooped in the sand about the size of a half-closed hand.

Mr. F. W. Kelsey (1902) says of their nesting habits near San Diego, California:

> In this section we seldom find a set of this species containing more than two eggs. The nesting places vary considerably, sometimes being merely a little wallow, 3 or 4 inches across, in the fine gray or black sand; at other times the eggs are deposited among coarse gravel and broken shells, while at others the nest is in the plain sand, but is more or less elaborately decorated with bits of rock, shell, or wood. In all cases, however, that have come to my notice, the nests have been on almost level ground, and entirely devoid of shelter.

Mr. A. I. McCormick (1899) describes their breeding grounds in Los Angeles County as follows:

> The beaches of this county, from Santa Monica southward, afford excellent breeding grounds for numberless birds of this species. The coast consists mainly of low sandy beaches, extending back 100 to 200 feet from the water's edge. Back of the beach proper come low sand hills, interspersed with small valleys, and farthest from the ocean are the higher lands, covered with a thick growth of low sage and other shrubs, about 200 feet from the water's edge. Water on the one side and sage brush on the other mark the boundaries of the nesting grounds of least terns, most of which last year (1897) arrived from the south about May 10. For 10 days they remained, flying high over the sea, seldom if ever coming within gunshot range.
>
> My second and last trip to the beach was made on June 5, when I was fortunate enough to take 15 sets of least tern's eggs. Six of them consisted of three eggs each. This is exceptional in the county. I have consulted several collectors who have had considerable experience with least terns in this locality, and with one or two exceptions two eggs has been the invariable complement found.

Judging from my own experience I should say that the least tern normally raises only one brood in a season, at least in the northern

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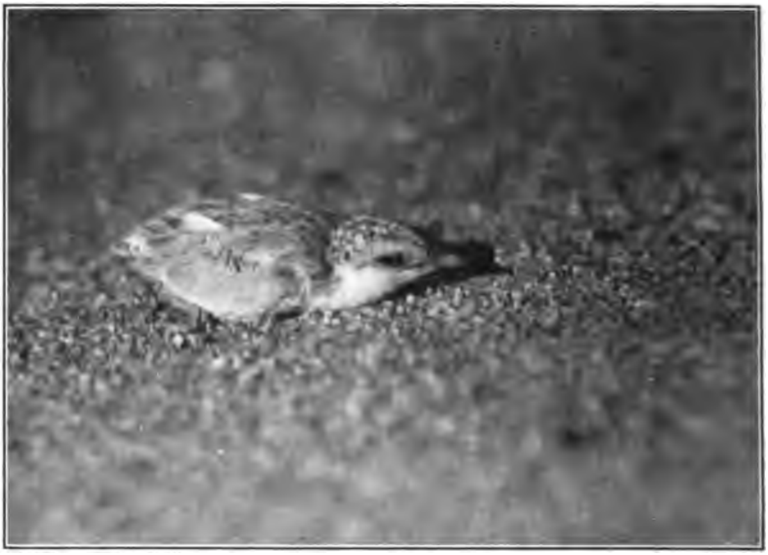
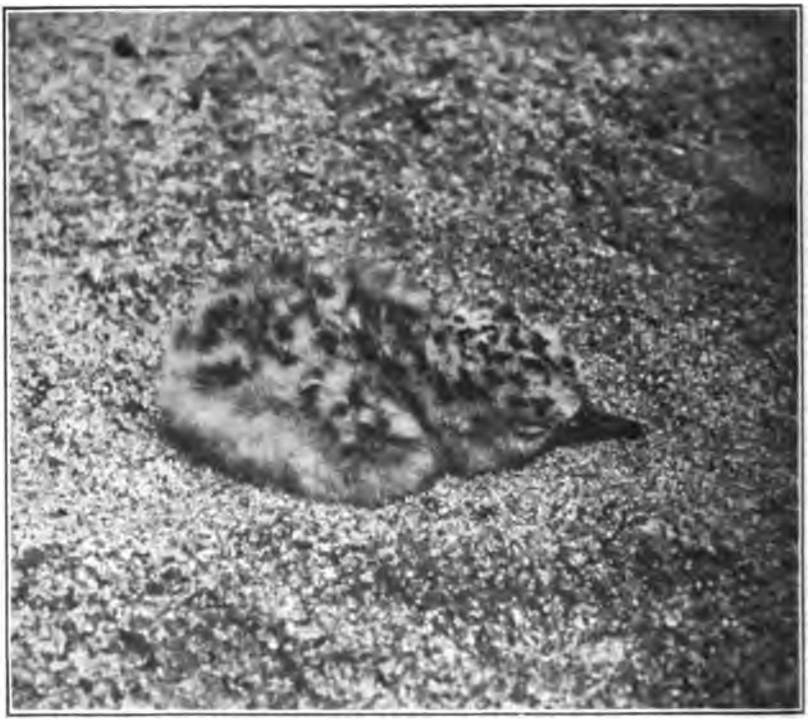


Marthas Vineyard, Massachusetts. E. H. Forbush.



Marthas Vineyard, Massachusetts. E. H. Forbush.

LEAST TERN.

FOR DESCRIPTION SEE PAGE 336.

portions of its range. But Mr. W. Lee Chambers (1908), in speaking of a protected colony in southern California, says:

> I should say that fully 75 per cent of the birds in this colony raised two or three broods.

Probably in warm climates, where the breeding season is more prolonged, second broods are more often raised.

Eggs.—The eggs of the least tern are good examples of protective coloration, for they match their surroundings remarkably well and can hardly be distinguished from mottled pebbles. The usual ground color varies from deep rich "cartridge buff" to very "pale olive buff," or to a color between "pale olive buff" and white. This is more or less unevenly sprinkled with small spots, and sometimes with a few large spots or blotches of dark shades of brown, such as "Mars brown," "sepia," or "mummy brown." Most eggs show some spots and many, particularly of the lighter types, show large underlying blotches of "Rood's lavender" or other shades of "lavender gray." Some eggs show very handsome patterns of bold dark markings over lighter shades. The shape varies from ovate to short ovate and the shell is thin and lusterless. The measurements of 63 eggs, in the United States National Museum, average 31 by 23.5 millimeters; the eggs showing the four extremes measure 37 by 24, 28.5 by 23 and 29.5 by 22 millimeters.

Young.—The period of incubation is said to be from 14 to 16 days. The young remain in the nest for a few days, but soon begin to develop powers of locomotion. They realize the value of the hiding pose and are well aware of their protective coloration; they lie prostrate on the sand, where they are nearly invisible, until almost touched, when they start up and run away with astonishing rapidity. When once started they seldom attempt to hide again and are very difficult to catch.

Mr. Edward H. Forbush has sent me the following interesting observations on the behavior of the young:

> Near me were two little young, just hatched and their down hardly dry, yet they were able to run about a little. Near by were several other youngsters. As I lay there propped up on my elbows, awaiting the return of the mother birds, several of them flitted back and forth, and soon their cheeping cries changed to a musical metallic "pidink," which has something of the tinkling quality of the bobolink's note. Soon the mother of the two nearest little ones alighted, and, running to her charges, settled easily upon them, shading them from the hot sun's rays. Then she turned her gaze upward and called softly in reply to the tender notes of the male, which circled overhead. Soon he alighted and took the mother's place in shading the young, while she flew away, perhaps to fish and bathe. Soon she returned with a little sand eel, which she gave to one of the tiny ones, who ran to her for it. Then she flew again, descended into the sea and returned to her charges which the male relinquished

to her care. She stood over them with ruffled feathers, and seemed to shake off some drops of water on their little panting forms, and then raised her wings a trifle to shade them from the hot sun. All this I saw at a distance of about 7 or 8 feet, and photographed some of it, the male meantime standing near by. He then took flight, and she nestled over the chick nearest me, coaxing him gently farther away by using her bill and calling the other, which finally followed to her new position and settled by her side.

Again the gentle twittering, and the father came down on the sand with a tiny, bright, silvery fish. A little one stuck its head out between the mother's wing and her body, the father courteously passed the fish to the mother, and she fed the chick, which begged for it with open mouth. Again the breadwinner winged his way over the sunny sea and returned with another fish. Now the little ones were asleep under the mother's breast. He offered her the fish. She refused it. He flew away, but soon alighted and proffered it again, only to be refused again. At last, having full assurance that his family did not need food, he swallowed it himself. Where shall we look to find a lovelier picture of happy, harmonious family relations than that shown here on this desolate beach, beside the roaring surf?

Plumages.—The colors of the downy young are very pale, to match their sandy surroundings. They are practically white, tinged locally above with "ivory yellow" or "pale olive buff," mainly on the crown and wings; they are spotted or mottled on the head and back with various shades of "mouse gray"; the under parts are pure white. When about half grown the juvenal plumage appears on the back and then on the head, "pinkish buff" on the back with U-shaped markings of "sepia" or "brownish olive," one on each feather. The pure white breast feathers appear at about this time, and the dusky wing quills are growing rapidly.

As the young bird attains its growth, in August, the colors become grayer, "pallid mouse gray," or "pallid neutral gray" on the back and wing-coverts; the forehead and crown "pale olive buff," with a dusky orbital and cervical crescent, and with numerous subapical, U-shaped spots of "brownish olive." The wing quills are gray, darker externally, and margined inwardly with white. The lesser wing-coverts, particularly on the bend of the wing, are mottled with dusky and the greater wing-coverts are white clouded with "pearl gray."

In the first winter plumage according to Coues (1877) the young bird begins to resemble the adult, but differs from it as follows:

> It is somewhat smaller, with considerably weaker bill, the basal portions of which are still more or less dirty flesh color. The forehead and vertex are rather grayish-white than pure white, and the brownish-black of the nape is interrupted with light grayish. The uniformity of the colors of the upper parts is interfered with by the still remaining lighter tips of most of the feathers, while some may yet retain the brownish subapical spots of the *avis hornotina.* The tail has still some traces of dark subapical spots. It is only in early winter that this particular plumage can be seen, for toward spring the birds are hardly to be distinguished from the adults.

The distinguishing features of this plumage usually disappear at a complete prenuptial molt in the spring. At the first postnuptial molt, which occurs in July and August, the young birds become wholly indistinguishable from adults. The winter plumage of the adult is mainly characterized by the brownish black occiput and nape, by the grayish black on the bend of the wing, and by the black bill. The adult nuptial plumage is produced by a complete prenuptial molt in the spring. It is characterized by the glossy black pileum, the pure white forehead, the yellow, black-tipped bill, and other minor points in which its differs from the winter plumage.

Food.—The least tern does not differ materially in its feeding habits from other species of the genus. It obtains its food, which is mainly small fish, by skimming over the surface or by hovering in the air and plunging down into the water after its prey. This plunging habit has given it the name of "little striker." It is very active while feeding and light and graceful in its movements, darting down upon its quarry with speed and accuracy. Its food is generally swallowed on the wing, but if not properly adjusted in the bill it is sometimes dropped and caught again before it reaches the water. Occasionally a bird will alight on the ground to devour its food, and often it flies away with it to feed its mate or its young. Mr. Ora W. Knight (1908) saw them in southern California "lightly skimming over the surface of the water and feeding on the various small surface-swimming crustaceans and small fish or engaged in feeding on various species of beach insects." The examination of 75 stomachs of birds by Warren (1890) killed on the New Jersey coast in summer "showed that they had fed almost exclusively on little fish; not more than four or five had any traces of insects in their stomachs." Audubon (1840) refers to their feeding on "shrimps and prawns." Sand eels are also eaten.

Behavior.—The flight of this delicate little "sea swallow" is exceedingly light, graceful, and buoyant; it is at times swift and well sustained. Audubon (1840) has well described its movements as follows:

> When you invade their breeding place they will sometimes sweep far away and suddenly return, coming so near as almost to strike you. While traveling their light but firm flight is wonderfully sustained, and on hearing and seeing them on such occasions one is tempted to believe them to be the happiest of the happy. They seem as if marshalled and proceeding to a merrymaking, so gaily do they dance along, as if to the music of their own lively cries. Now you see the whole group suddenly check their onward speed, hover over a deep eddy supplied with numberless shrimps, and dash headlong on their prey. Up rises the little thing with the shrimp in its bill, and again down it plunges, and its movements are so light and graceful that you look on with pleasure and are in no haste to depart. Should this scene be enacted while

they have young in their company the latter await in the air the rise of their parents, meet them, and receive the food from them. When all are satiated they proceed on their journey, stopping at another similar but distant place.

When their breeding grounds are invaded these terns show their anxiety by hovering over the intruder or darting down at him with shrill, strident cries of protest. Wilson (1832) described their cries as sounding like the "squealing of young pigs." Their ordinary call note, the one most often heard on their breeding grounds, is a shrill, rasping cry, sounding like the syllables "zree ee eep." They also have a variety of cackling and whistling notes. When attacking an intruder, at which they are very bold, they utter a sharp "yip" or a series of vehement notes like "keck, keck, keck," rapidly repeated. While hovering over a school of small fish they become very much excited and noisy, indulging in a constant chorus of shrill cries.

Least terns are particularly gentle and harmless birds. They are not as sociable as some other species, but they live in perfect harmony with their neighbors on their breeding grounds. They seem to prefer the same localities, and become intimately associated with piping plovers, Wilson's plovers, and snowy plovers in their respective breeding ranges. Their chief enemies are human beings, who shoot them and destroy their eggs, and dogs, cats, and rats, which eat their eggs and young. Fortunately protection has come in time to save this beautiful species from complete extermination, with which it certainly was threatened.

Winter.—There is not much to be said about their winter habits, for most of them spend the winter south of our borders in warmer climes, though a few winter on our southern coasts. They are more given to wandering during the fall and winter, and are more often seen inland then than at other seasons.

DISTRIBUTION.

Breeding range.—All along the Atlantic coast, from Massachusetts (Chatham) to the Florida Keys, and along the Gulf coast to southern Texas (Cameron County). Islands in the Mississippi and Missouri Rivers; north, formerly at least, to southern South Dakota (Vermillion) and central northern Iowa (Clear Lake); and west to northern Nebraska (Niobrara River) and southwestern Kansas (Cimarron River). From the Bahamas (Andros, Abaco, Eleuthera, Watlings Island, etc.) and the Greater Antilles (Cuba, Porto Rico, Cayman Islands, etc.), southward throughout the Lesser Antilles to Venezuela (Aruba and Bonaire Islands), and westward to British Honduras. On the Pacific coast, from central California (Monterey Bay) southward to southern Mexico (Tehuantepec). Pacific coast birds are now considered subspecifically distinct.

Breeding grounds protected in the following national reservations: In Florida, Mosquito Inlet, Tortugas Islands.

Winter range.—From the Gulf of Mexico (Louisiana coast) south, along the east coasts of Central and South America, to Argentina (Corrientes); and from the Gulf of California, south, along the west coast to Peru (Sarayacu).

Spring migration.—Early dates of arrival: New Jersey, Long Beach, May 12; Rhode Island, Newport, May 15; Massachusetts, Chatham, May 2; Nebraska, April 2.

Fall migration.—Late dates of departure: New York, September 11; New Jersey, Long Beach, August 25; Maryland, Baltimore, September 4; Kansas, Emporia, August 12; Missouri, St. Louis, August 31; Texas, Bonham, August 20; Lower California, San José del Cabo, September 6.

Casual records.—Said to wander in summer north to Minnesota, Ontario, and Nova Scotia, but many of the records are doubtful. Labrador and Newfoundland records are very doubtful. Occurs occasionally in winter on Atlantic coasts of Africa.

Egg dates.—California: Eighty-nine records, May 20 to August 12; forty-five records, June 5 to 25. South Carolina and Georgia: Thirty-seven records, May 8 to July 20; nineteen records, May 21 to June 21. Florida: Fourteen records, May 3 to June 29; seven records, May 8 to 21. Massachusetts: Eleven records, May 29 to July 4; six records, June 2 to 29.

STERNA FUSCATA Linnaeus.

SOOTY TERN.

HABITS.

This wide ranging species, represented by different races in the two hemispheres, gathers for the purpose of breeding into numerous vast colonies on remote islands in the tropical waters of both oceans, where it is one of the best known sea birds and one of the most popular as a producer of eggs for food. Its most famous resort is probably Bird Key in the Dry Tortugas, near the Florida Keys, about which much has been written, beginning with Audubon's (1840) graphic account, from which I quote, as follows:

> On landing I felt for a moment as if the birds would raise me from the ground, so thick were they all around and so quick the motion of their wings. Their cries were indeed deafening, yet not more than half of them took to wing on our arrival, those which rose being chiefly male birds, as we afterwards ascertained. We ran across the naked beach, and as we entered the thick cover before us, and spread in different directions, we might at every step have caught a sitting bird, or one scrambling through the bushes to escape from us. Some of the sailors, who had more than once been there before, had provided themselves with sticks, with which they knocked down the birds as they flew thick around and over them. In less than half an hour more than a hundred terns lay dead in a heap, and a number of baskets were filled to the brim with eggs.

> It was curious to observe their actions whenever a large party landed on the island. All those not engaged in incubation would immediately rise in the air and scream aloud; those on the ground would then join them as quickly as they could, and the whole forming a vast mass, with a broad extended front, would as it were charge us, pass over for 50 yards or so, then suddenly wheel round and again renew their attack. This they would repeat six or eight times in succession. When the sailors, at our desire, all shouted as loud as they could, the phalanx would for an instant become perfectly silent, as if to gather our meaning; but the next moment, like a huge wave breaking on the beach, it would rush forward with deafening noise.

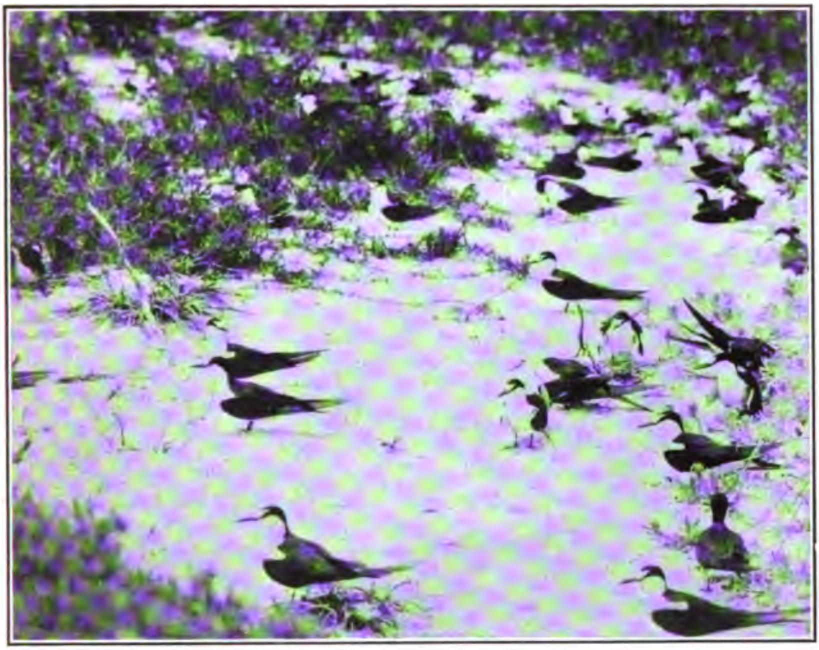
Spring.—A description of this island is given in the life history of the noddy. Dr. Joseph Thompson (1903) says that sooty terns arrive about a week after the coming of the noddies; they "arrive in larger flocks and they all seem to reach the breeding place within about four days. Within a week of the arrival of the first one their eggs are to be found."

Courtship.—Audubon (1840) witnessed the courtship of this species, of which he writes:

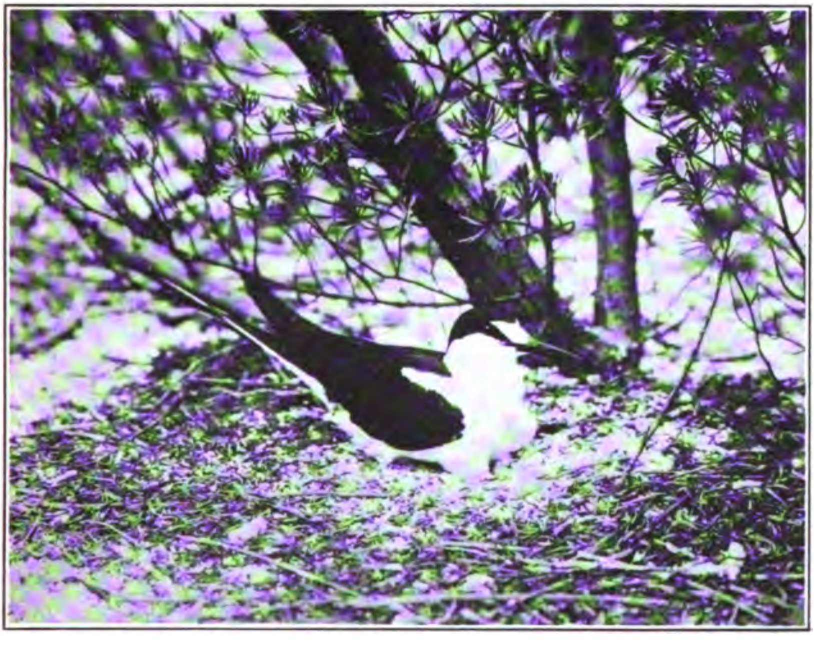
> The male birds frequently threw their heads over their backs as it were, in the manner of several species of gulls; they also swelled out their throats, walked round the females, and ended by uttering a soft puffing sound as they caressed them. Then the pair for a moment or two walked round each other, and at length rose on wing and soon disappeared.

Nesting.—From Prof. John B. Watson's (1908) careful observations of this species and the noddy, made in this colony, we have learned much regarding their habits and characteristics. Some of this information I shall attempt to give in concise form or in exact quotations from his excellent paper, to which I would refer the reader for details. Regarding the nest-building activities he says:

> The building of the sooty nest is quickly accomplished. The obtaining of a nest site is the difficult part of the reaction. As has been said, the sooties build their nests very near one another. For this reason it is extremely difficult to make complete observations. My observations began late one afternoon, before any eggs had been laid. Hundreds of the birds were grouped together, incessantly fighting and screaming. It quickly became apparent that most of them had chosen a nest site and were defending it against all late comers. Both male and female were present. Each pair in this particular locality defended a circular territory, roughly 14 inches to 2 feet in diameter. Other birds in wandering around would stumble into this sacred territory and a fight would ensue. The fights would often lead to encroachments upon the territory of still other birds. The number of those fighting would thus be constantly increased. I have seen as many as 14 sooties thus engaging in a fight. Birds 10 to 15 feet away would rush into the fight and the noise and confusion beggared description. Sometimes as many as 10 or 15 such fighting groups could be observed in the area of 1,000 square feet. Quiet would momentarily ensue and then be broken by another series of fights. During the choice of the nesting site the fights continue day and night, with only intermittent periods of quiet.



Dry Tortugas, Florida. H. K. Job



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> Within this charmed circle the two mated birds remain relatively quiet. At this time sexual activity is at its height. It frequently happened in the sexual process that the two birds would step ouside of their own territory and a general fight would ensue. When the sexual reaction is in progress it is a signal for the surrounding males to encroach. Coition is thus completed only after much fighting. I have seen the male attempt to mount the female 12 to 15 times, and at each attempt be interfered with by neighboring males.
>
> The actual construction of the nest, when a nest structure is formed, begins after an undefended area has been found. The process of nest building is somewhat as follows: The bird puts the breast to the ground, thereby supporting the body and leaving the legs comparatively free. The feet are used as a combined scraper and shovel. A few backward strokes of the feet are made, which serve both to loosen the sand and to remove it from beneath the body. The bird then turns slightly and repeats the process. When it has turned 360°, or less, it begins to use the breast as a shaper. By continuing this process the depression is soon made to assume the required diameter and depth. My notes show that the bay-cedar leaves are often gathered up and placed around the rim of the nest as the hole is being dug. I can not say which sex does the work, but I believe that both male and female engage in it. As soon as the depression is made both birds begin to defend it. Naturally, where no nest is made, the nest site alone is chosen and defended as described above.
>
> The nest of a sooty, when a nest is made, consists of a shallow oval depression in the sand. This depression varies greatly in depth, depending upon the nature of the surface. It is rarely over 5 centimeters in depth, even in loose sand.
>
> The northern and northeastern sections of the island are free from bushes, but are covered by a shallow growth of Bermuda grass. These areas contain by far the largest number of nests. The eggs in these areas are laid literally on the grass and bare earth in no kind of nest structure. The eggs are often deposited in open sandy places, but nest depressions are not always made, even where the nature of the surface easily permits it.
>
> A rather interesting variation in nest structure appears among certain nests which are built under the bay-cedar bushes. The leaves from the bushes sometimes form a carpet over the sand. The nesting sooties often gather up these leaves and place them around the rim of the depression. Under no circumstances are the leaves collected from a distance farther than the birds can reach with their beaks while remaining in a sitting posture in the nest.

Mr. B. S. Bowdish (1900) found a large colony of these terns breeding on Desecheo Island, near Porto Rico, under quite different conditions, which he describes as follows:

> The nesting sites were ledges or shelves in the face of the rocky walls, ranging between 10 and 40 feet above the beach. Some were narrow and others wide. In one case the egg was laid underneath a cactus plant on top of the rocks. In some instances there seemed to be a slight gathering of rock chips and small pebbles about the eggs in the form of a ring, and in a very few one or two bits of twigs were added, but otherwise there was no nesting material, and often the egg laid on the bare rock.

The Pacific form of the sooty tern (*Sterna fuscata crissalis*) breeds on several islands on the west coast of Mexico and in the Hawaiian group, congregating in vast colonies, surpassing in extent and density any tern colonies that I have ever heard of elsewhere. Mr. E. W. Gifford (1913) says:

> Messrs. Beck and Hunter reported sooty terns nesting by thousands on several low, flat islets in the brackish lagoon at Clipperton Island. On one islet, about 800 square feet in area and 10 inches in elevation above the water of the lagoon, there were over a thousand eggs. They were laid on the bare coral, with no semblance of a nest, and were so closely placed that it was necessary to step with extreme care to avoid crushing them. The owners were very fearless and allowed themselves to be handled freely. They were also very noisy and kept up a great din. On the 9th 400 eggs were collected by the two residents of the island from a space 20 by 20 feet, and by 11 a. m. on the 10th over 100 fresh ones had been laid in the same area.

The colony on Laysan Island is probably the largest, and it certainly is a wonder among wonders. Prof. Homer R. Dill (1912), reporting on the condition of this colony, states:

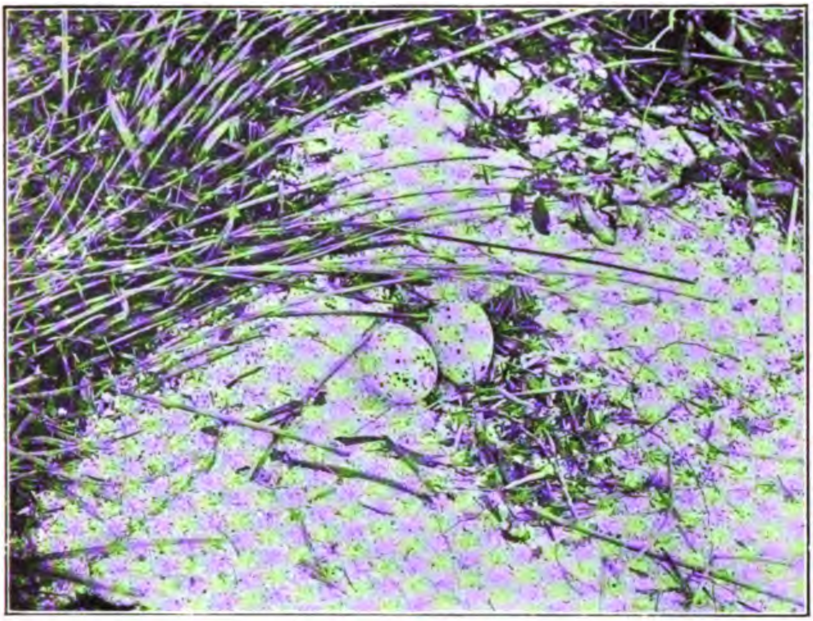
> The first day of June we measured the rookeries of these birds and two days later we went over the same ground again. We found that in two days the rookeries on the west side had increased in area 3,600 square yards. The final estimate of the number of sooty terns was made June 4—333,900 for both rookeries. This species outnumbers any other on the island.

Dr. Walter K. Fisher (1906), writing of the same colony, says:

> The sooty terns nest in among the tall grass, and the single egg is laid directly on the sand, with sometimes scarcely a hollow to suggest a nest. The eggs are placed very close together in many localities—so close that it is sometimes difficult to progress and not walk on them. The birds are very loath at times to leave their nest, and scold soundly before finally slipping off. When at last driven, they limp away, dragging their wings in a painful manner, just as our own birds do. Thus, here, on a little island, is this firmly implanted instinct strongly in evidence, and practiced where it can be of no possible advantage to the bird. Sometimes a dozen or more will struggle on ahead of the pedestrian, trampling over each other and crying incessantly, kicking eggs to the right and left in a mad endeavor to escape, while overhead their fellows keep up an incessant screaming. There is always a great cloud of these birds flying back and forth over the colony, even when no disturbing element is present. They seem to need the nervous excitement. Just at sunrise they are spontaneously most noisy, for they apparently are returning from the sea, where I have heard them at various times during the night.

Eggs.—The same writer gives a very good description of the eggs of the sooty tern, and I can not do better than quote his words, as follows:

> The eggs of the sooty tern vary much in markings, but can usually be told from those of *Sterna lunata* by greater size and usually coarser spotting. The ground color is white or occasionally a cream buff. One type of marking consists of deep burnt sienna and grayish vinaceous spots, with occasional nearly black scrawls scattered rather evenly over the whole surface. The spots are 1, 2, and 3, mm. in diameter, with occasional larger and smaller ones. Another less prevalent variation consists of heavy, very deep burnt sienna blotches (5 mm. to 15 mm. in extent), congregated in a zone near the blunt end, and lesser pale grayish vinaceous and deep burnt sienna spots sparsely scattered



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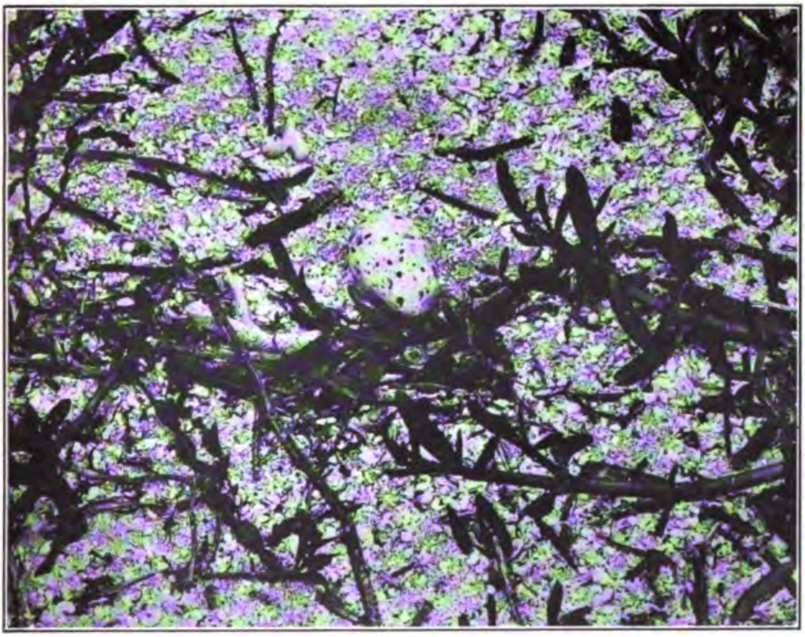

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over the rest of the egg. A very handsome type has the brown laid over the vinaceous, and occasionally the deep burnt sienna or chestnut shading off to one side into light, caused by the spiral twisting of the egg in the oviduct. One specimen shows this to a marked degree, having long chestnut daubs extending spirally from the big end. Still another type has fine brown and grayish vinaceous maculations scattered all over the egg, but more numerous at the blunt end. An abnormal specimen is entirely without markings, being pure white. The shape is ovate, either elongate or thick. An average specimen measures 58 mm. by 35 mm.

The measurements of 76 eggs, in the United States National Museum collection, average 50 by 35 millimeters; the eggs showing the four extremes measure 56 by 36, 54.5 by 37.5, 44.5 by 35 and 48.5 by 33 millimeters.

Young.—Both sexes incubate, and, according to Prof. Watson's observations, the shift is made during the night, each bird remaining on the nest 24 hours except for occasional short excursions for water. The incubating bird is evidently fed by its mate. Based on the study of 16 nests he determined that the period of incubation is 26 days. During the first three days after the young are hatched they are closely guarded by their parents, after which they learn to "run to the bushes, where they remain motionless after sticking their heads into the crotch of some bush or depressing the body against any convenient solid object." The parents soon learn to recognize their own young, and the young learn to respond to the calls of the parents. Each bird feeds it own young and attacks the young of any other bird which invades its territory. This leads to many fights among the adults and much mortality among the young. Professor Watson (1908) says:

> The parents alternately feed the young, but instead of a diurnal period of feeding, such as the parents have before the appearance of the young, the intervals vary anywhere from four to seven hours. My observations are few on this point. Though the parents feed the young at any hour of the day, feeding can be most easily observed at dusk. It has already been mentioned that the sooties hurry home at nightfall in great numbers. From 4 until 8 p. m. this feeding process keeps the island in commotion. The feeding of the young birds has many interested spectators. While I have never seen the terns from the neighboring nests, which may be observing the process, attempt to rob the young bird, I judge from the actions of the feeding parent that such is occasionally the case. If the parent happens to disgorge more than the young tern can take into its beak, and the food is allowed to fall to the ground, it is ludicrous to watch the rapidity with which the parent picks up the food and reswallows it. Often times the mate of the feeding parent is near; its rôle is a purely passive one, except when the "spectators" attempt to approach too near. Its part is then to assist in warding them off.
>
> The care of the young, especially from 20 days on, must be an exhausting process for the parents. They become emaciated and somewhat bedraggled in appearance. This is not to be wondered at when we consider that a healthy young sooty can eat anywhere from 20 to 40 minnows of no insignificant size

in a day. It may be of general interest to note that after the first few days the parent always recognizes and feeds its own young and no other, and, furthermore, the young tern recognizes its own parents and attempts to feed only from them. Never but once out of many thousands of observations did I see a young tern begging food from a stranger.

Plumages.—I have seen two quite distinct types of downy young. In one the upper parts are variegated with "chamois buff" and black; in the other the upper parts are deep sooty or brownish black, the down on the head and neck being tipped with "ochraceous buff." These colors include the sides of the head, neck, and body, in each case, and the under parts are pure white. Mr. Gifford (1913) describes some downy young, collected on Clipperton Island, as "streaked with grayish brown and dull white on the upper surface, but the white down is tipped with rufous."

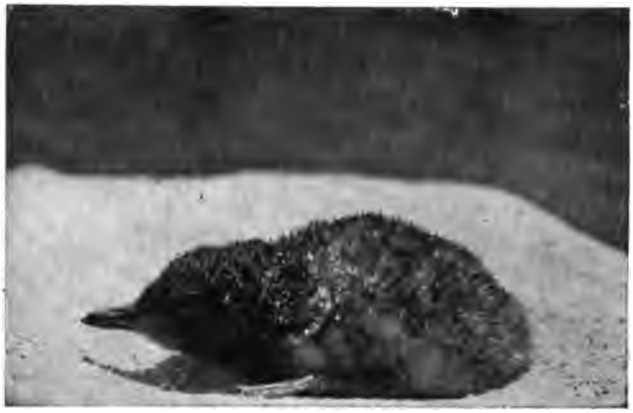
When about 30 days old the young bird is fairly well clothed in its juvenal plumage. In this plumage the upper parts are "clove brown"; the back, upper tail-coverts, and wing-coverts are narrowly edged with buff; the scapulars are broadly tipped with buffy white; and the under parts are uniform "olive brown," shading off to grayish white on the belly and crissum. The bill is small and the tail is square, or nearly so. Probably the light edgings wear away during the winter and apparently a complete prenuptial molt takes place in the spring. I have seen birds in summer, apparently about a year old, with long wings and forked tails, in which the crowns and upper parts are "fuscous black," the foreheads white, and the under parts white, heavily clouded with dusky. At the next molt, the first postnuptial, the adult winter plumage is probably assumed. This differs from the adult nuptial plumage only in having a few scattering white feathers in the crown and the lores. I have not seen sufficient material, collected at the proper seasons, to work out the seasonal molts of the adult.

Food.—The food of the sooty tern seems to consist almost entirely of small fishes, which it picks up gracefully off the surface of the sea without wetting its plumage. Audubon (1840) says:

> Like some of the smaller gulls, this bird not infrequently hovers close to the water to pick up floating objects, such as small bits of fat pork and greasy substances thrown overboard purposely for making the experiment.

Dr. E. W. Nelson (1899) says of the Pacific variety:

> They feed well out at sea, and were not found anywhere along shore, except when they came to their roosting place on Isabel Island. There were no signs of their roosting about the Tres Marias, although they may roost on some of the outlying rocky islets. Grayson found them in small numbers farther west, about the Revillagigedo Islands. During our trip to the Tres Marias many schools of large fish were encountered swimming close to the surface and constantly breaking, often with such force and rapidity that the water boiled and foamed over considerable areas. These schools of fish were commonly accom-



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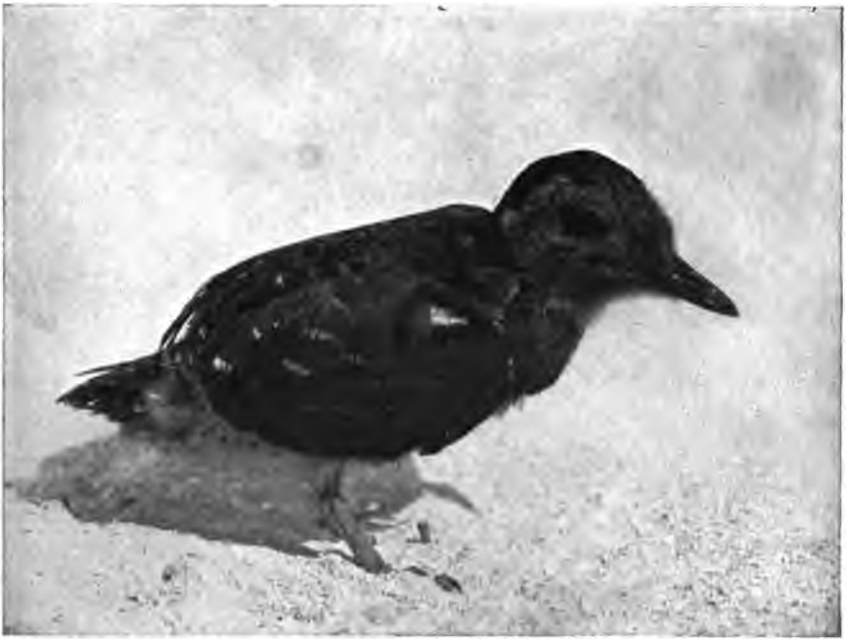

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panied by flocks of sooty terns and gannets, which appeared to be animated by the wildest excitement. The terns hovered over the foaming sea, uttering shrill cries and darting down into the water, evidently after food; and in the midst of the turmoil the blue-footed gannets swam about, beating the water with their wings and adding to the noise made by the terns and leaping fish. While on Maria Madre I saw a flock of terns some distance offshore, and, taking a canoe, managed to get out to them and directly in the course of the school of fish they were accompanying. Letting the boat drift I stood up and watched the swarm go by. Thousands of large fish and hundreds of terns and gannets passed the boat on every side, amid loud cries from the terns, a rushing sound from the fish and gannets, and a bewildering complexity of motion in sea and air that was intensely exciting. This novel sight was so interesting that I came near losing a chance to secure some of the birds.

Behavior.—Dr. Frank M. Chapman (1908) says of the flight of this species:

> Sooty terns in flight are much like common terns, and, when alarmed, they have the common tern's habit of hanging in the air above their nests. Because of their comparative tameness and of the steadiness of the easterly trade wind, an admirable opportunity was presented to observe these birds in the air at close range. So even was the breeze that the birds, all facing it, seemed to be suspended and motionless. There was, in truth, but little change in their position, but it was maintained by constant adjustment to the slight variations in the force and direction of the wind. Wings were raised or lowered, widely spread, or partly closed; tails depressed or slightly elevated, and fan-like, opened or shut. In short, there was a ceaseless, if unconscious, effort on the part of the birds to maintain the balance between gravity acting in one direction, and air pressure in another, and so well did they succeed that it was a common sight to see one put its foot through its inner wing feathers and scratch its ear with as much ease as though it had been on its nest.

Professor Watson (1908) noted that the sooty tern seldom, if ever, perched upon the stakes, buoys, or other resting places, as the noddy does, but spends most of its time on the wing when away from its breeding place. He writes:

> I think the sooty always leaves the island and returns to it without at any time having ceased its flight. This seems rather remarkable when we take into account the fact that the sooty leaves the island in the early morning and oftentimes does not return until toward nightfall.
>
> The sooties often soar round and round, getting higher and higher until lost to sight. They usually join the frigate birds in this reaction. I am inclined to think that the sooty when sufficiently fed spends a large part of its time in such maneuvers.

Audubon (1840) also remarks that this "species rarely alights on the water, where it seems incommoded by its long tail;" also that it "never dives headlong and perpendicularly, as the smaller species are wont to do, but passes over its prey in a curved line, and picks it up. Nor is the flight of this tern characterized by the buoyancy and undecidedness, if I may so speak, of the other species mentioned above, it being as firm and steady as that of the Cayenne tern, excepting during the movements performed in procuring its food."

On its breeding grounds the sooty tern is not only a very active and nervous bird, but a very noisy one as well. Its shrill, piercing cries create an incessant din; it is almost never quiet, even at night. One can hardly make himself heard in the rookeries by day and it is difficult to sleep near them at night. Doctor Chapman (1908) describes the notes as follows:

> The sooty's common flight note is a squeaky quack and a clearly enunciated, high-pitched ker-wacky-wack. Nesting birds when disturbed uttered a sharp barking note, changing to a long-drawn, aggressive squawk, suggesting the notes of an annoyed brooding hen. Indeed, as one crawled through the more or less open spaces beneath the bushes with birds protesting or retreating, one seemed to have invaded a densely populated hen yard.

Mr. C. J. Maynard's (1896) version is only slightly different. He says:

> The ordinary notes of the sooty tern are extremely harsh, sounding like "Quanck," "quanck;" but when disturbed on their breeding grounds they utter a double note like "qu-ank." They also, at such times, emit a snarling sound, when all the terns on the key will dive downward, and darting outward, fly over the surface of the water a short distance, scattering in every direction, but will immediately return, and gathering over the intruder, commence their noisy cries, continuing until another one of them chances to give this peculiar sound, when off they will go again, repeating the maneuver over and over again, as long as the object of their aversion remains on the key.

Winter.—After the breeding season is over and the young birds are able to fly the sooty terns leave their breeding grounds and wander about the neighboring seacoasts, sometimes much farther north. Many of them winter in the Gulf of Mexico and among the West Indies, while others wander south along the tropical coasts of South America.

DISTRIBUTION.

Breeding range.—The Atlantic form breeds from the Florida Keys (Dry Tortugas) eastward throughout the Bahamas (Atwoods, Gauldings, and Ship Channel Keys, Acklin, Eleuthera, Watlings, and Berry Islands, etc.). Southward throughout the West Indies (Cuba, Jamaica, Porto Rico, Dominica, Guadeloupe, Carriacou, etc.) to Venezuela (Margarita Island). Westward to British Honduras (Belize). Northward, formerly at least, to southern Texas (Cameron and Nueces Counties). Also on tropical islands in the Atlantic Ocean at least as far south as equatorial Brazil (Fernando Noronha Island) and Ascension Island. Other forms are widely distributed in the Pacific Ocean and adjacent seas.

Breeding grounds protected in the following national reservations: In Florida, Tortugas Keys.

Winter range.—Practically resident throughout most of its breeding range. Winter range extends north to the Louisiana coast and south to Patagonia (Ascension), Tristan da Cunha, and the Falkland Islands.

Casual records.—Has wandered north (numerous records) as far as Maine (Piscataquis County, October 5, 1878), and New York (Lake Champlain, September 6, 1876). Several Bermuda and European records, such as England (near Wallingford, June 21, 1869), and France (near Verdun, June 15, 1854).

Egg dates.—Bahama Islands: Forty-eight records, May 6 to June 10; twenty-four records, May 18 to June 2. Texas: Eight records, May 10 to 22. Florida: Six records, April 10 to June 5; three records, May 2 to 21.

STERNA ANAETHETA Scopoli.

BRIDLED TERN.

HABITS.

The bridled tern so closely resembles its near relative, the sooty tern, that it can hardly be distinguished from it in life by the casual observer. The two species are intimately associated and very abundant among the tropical islands of the West Indies, although the sooty is much more abundant than the bridled tern in most localities and is more widely distributed. Owing to the difficulty in distinguishing the two in life very little comparative study of the two has been made, and very little has been published about the habits of the bridled tern, but probably most of its habits are similar to those of its better-known relative. Both species are known to the island natives as "egg birds," about which Dr. Frank M. Chapman (1908) says:

> Throughout the Bahamas the name "Egg bird" is applied to the sooty, bridled, and noddy terns. The latter part of April these birds come in large numbers to certain regularly frequented keys to breed. If their resort be near a settlement, they are robbed of their eggs by its inhabitants. In Nassau I have seen many of them offered for sale on the street, each one with the shell punctured as a guarantee that one was not buying a tern. If they are remote from human habitation, they are generally preyed upon by the cruising spongers, to whose scanty bill of fare fresh eggs are an eagerly sought addition. Doubtless there are but few colonies of terns in the Bahamas that do not contribute to the food supply of the usually hungry native, hence the current name egg bird. Efforts to secure the passage of a law prohibiting the taking of the eggs of these birds has failed, and, sentiment aside, provided they are permitted to breed and their numbers therefore not decreased, there seems to be no reason why, in a country of such limited food products, this source of supply should not be drawn upon.

Nesting.—Although it often resorts to the same islands to breed, its nesting habits are somewhat different from those of the sooty tern, as the following brief accounts, selected from a large number, will show:

Mr. B. S. Bowdish (1900) found a small colony nesting on Desecheo Island, near Porto Rico, on June 23, of which he writes:

> These birds are nothing like as common as the noddy. I think it doubtful if 50 pairs of birds were breeding on the entire island. They are also, I should judge, later in their breeding, the only three nesting sites which I found occupied containing a single egg in which incubation was only just commenced. Also I noted birds showing strong anxiety regarding certain nooks under the rocks, quite similar to those where eggs were found, and I have no doubt that these were nesting sites selected but not yet laid in. In one such case the native caught the male bird on the nest, or at least in the nook.
>
> The first egg was found in a slightly hollowed spot on a flat rock and arched over by a small rock. No pretense at nesting material whatever. The second was in a sort of pocket in the face of the cliff at about 40 feet above beach. The third was under an overhanging rock about 10 feet above beach. From the small amount of data I should judge that the birds almost always select rather hidden and covered sites, and from this fact, and the further one that they do not sit nearly so close as the noddy, their nests are not so easily found, the noddy tern being usually easily seen in its nesting ledge, whereas the bridled leaves its nesting site with a dash often before you see it.

Dr. George W. Field (1894) gives a good account of a small colony near Kingston, Jamaica, as follows:

> At the entrance to Kingston Harbor are several cays, varying in size from a mere sand bank to islands of an acre or more in area. The larger of these are dignified by names. Between South Cay and Drunkenman Cay there is a small island, composed entirely of broken coral rock; in reality it is merely a part of the barrier reef above water. Close by and to the southeast of this is a larger, sandy cay, with a few broken slabs of loose coral rock, the western end of which is covered with mangroves. Upon the former of these islands we found, June 15, about a dozen pairs of bridled terns, evidently breeding, but from the nature of the place we were able to find but a single young bird in the down, for the slabs piled in confusion furnished a labyrinth into which they beat a hasty retreat and from which they were not easily dislodged. Leaving the island we landed on the wooded island last mentioned and here we found three or more pairs breeding. Under a flat rock, supported at one end by another rock, we found the single egg laid as usual on the bare sand; the bird darting out at our approach betrayed the place.

Eggs.—The eggs of the bridled tern are somewhat similar to those of the sooty tern, and are nearly as handsome, but they do not show such a wide range of variation and are usually much more finely and evenly spotted, the bold, striking color patterns being seldom seen. The ground color is pinkish white, creamy white, or pure white, which is generally well covered with rather small spots of a great variety of shades of brown, from the darkest shades to bright reddish brown, also various shades of drab, gray, violet, and lavender; occasionally an egg is boldly splashed or blotched with violet-gray or lavender, overlaid with bold markings of brilliant shades of brown, and producing a very pretty effect. The measurements of 20 eggs in the United States National Museum average 46 by 33.2 millimeters; the eggs showing the four extremes measure **49.5** by 31.7, 47.5 by **35.5**, **40.6** by 31.7 and 43.1 by **31.2** millimeters.

Plumages.—The downy young bridled tern is gray, to match the rocks on which it is born. The color varies from very light gray to dark gray or drab-gray, and it is usually tinged with buff; the under parts are grayish white and the throat is dark gray; the upper parts are more or less mottled with dark brown. The young bird, in the juvenal plumage, has the forehead and the entire under parts pure white. The crown and hind neck is "light gull gray," lightly streaked on the crown and heavily streaked on the cervix with black. The feathers of the back, lesser wing-coverts, or scapulars, are edged with pale buff, which fades or wears away during the fall and winter, leaving the back "gull gray" and somewhat mottled. The sequence of plumages to maturity, so far as we can tell from the limited material available, is apparently similar to that of the other small species of the genus *Sterna.* The same is probably true of the molts and plumages of the adult. The adult in winter may be distinguished from the young of the year by having no buffy edgings on the upper parts, but the fresh feathers of the back are broadly tipped with very "pale gull gray," or whitish; and the head is more distinctly marked with black and white, though in a similar pattern to that of the young bird.

Food.—Dr. Alexander Wetmore (1916) says of the food of the bridled tern:

> Of five stomachs examined one was entirely empty. Fish remains were present in all the other stomachs, and amounted to 70 per cent. One species was identified as a filefish (*Alutera*, species). Mollusks (25 per cent) were represented by a gastropod and a cephalopod (*Spirula australis*), the latter one of the few of that order bearing a shell that exist to-day. Miscellaneous matter (5 per cent) consisted of a moth and a small echinoderm. Fish and marine mollusks form the large bulk of the food, and under present conditions the birds are to be considered harmless, as the fish eaten are not of economic importance.

In its feeding habits, flight, vocal performances, and general behavior it is apparently similar to the sooty tern. I can not find that anyone has noted any special peculiarities of the bridled tern. On its breeding ground it is often intimately associated with other tropical terns in large colonies, also with boobies and other water birds, with all of whom it seems to live in perfect harmony. At the close of the breeding season, in August or September, it leaves with the others and wanders about over adjacent seas and coasts during the winter.

DISTRIBUTION.

Breeding range.—The American form breeds in the Bahamas (Acklin, Eleuthera, and Berry Islands, Atwoods, Samana, French, and Gauldings Keys, etc.). Southward throughout the West Indies (Dominica, Jamaica, Porto Rico, St. Thomas, etc.) to Venezuela (Aruba Island). Westward throughout the Caribbean Sea to

British Honduras (Saddle Cay). Other forms are found in the Eastern Hemisphere and in the Pacific Ocean.

Winter records.—Practically the same as the breeding range.

Casual records.—One record each for South Carolina (Frogmore, August 25, 1885), Georgia (coast, September, 1912), and Florida (Audubon's specimen, probably taken in Florida Keys).

Egg dates.—Bahama Islands: Thirty-three records, April 12 to June 26; seventeen records, May 16 to June 8.

CHLIDONIAS NIGRA SURINAMENSIS (Gmelin).

BLACK TERN.

HABITS.

A prairie slough, teeming with bird life is one of the most fascinating spots for an ornithologist, for nowhere else can he come in close touch with such a variety of species of interesting birds, with such a multitude of individuals crowded into a narrow space and under such favorable conditions for observation. I have never enjoyed anything more keenly than the long drives we used to take over the virgin prairies of North Dakota, drawn by a lively pair of unshod bronchos, unconfined by fences or roads, with nothing to guide us but the narrow wagon ruts which marked the section lines and served as the only highways. In those days the prairies were like a sea of grass, as boundless as the ocean and nearly as level, where only the distant horizon marked the limit of our view. The prairie birds were interesting but widely scattered over a vast area. In the timber belts along the streams the small land birds were swarming in the only available trees; but the real bird life of the region was to be seen in the thickly populated slough. We seemed to be driving on and on into limitless space until suddenly we came to a depression in the prairie marked by a steep embankment, and there, 10 feet below the level of the prairie, lay a great slough spread out before us. Various ducks—mallards, pintails, shovellers, and blue-winged teal—began rising from the surface as we appeared, and way out in the open water in the center of the slough we could see redheads, canvasbacks, and ruddy ducks swimming about in scattered flocks. An occasional pied-billed or horned grebe and scores of coots were scurrying in and out among the reeds, clucking and scolding or pattering away over the water. Ring-billed and Franklin's gulls and a few Forster's terns were floating overhead. The loud cries of marbled godwits, western willets, and killdeers betokened their anxiety as they flew about us. Dainty little Wilson's phalaropes were flitting about the edges of the marsh, and from the recesses of the reeds came the cackling notes of soras and Virginia rails. Blackbirds, redwings, and yellowheads fairly swarmed in the

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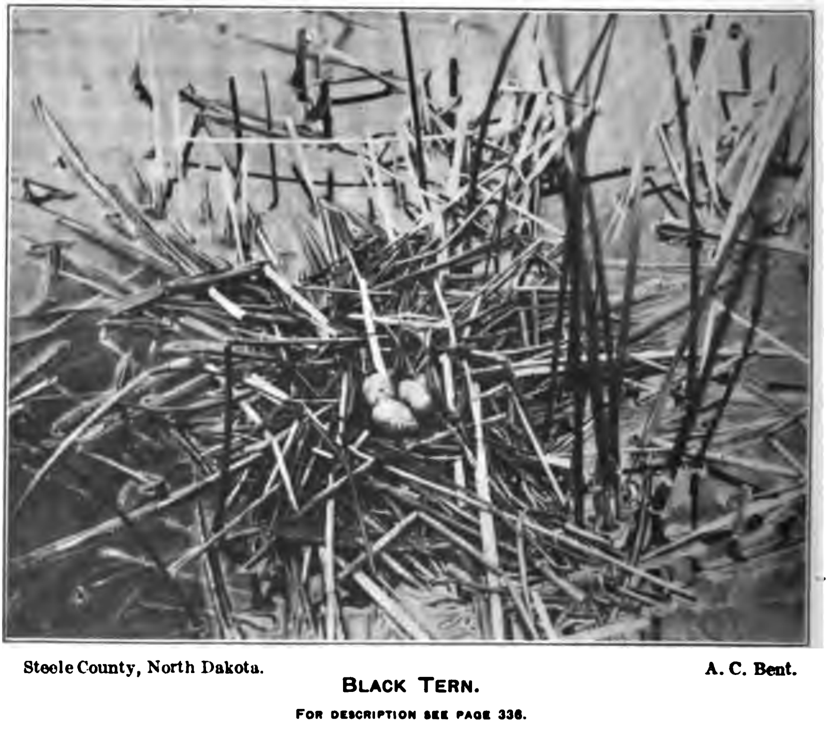
Steele County, North Dakota. A. C. Bent.



Steele County, North Dakota. A. C. Bent.

BLACK TERN.

FOR DESCRIPTION SEE PAGE 336.

reeds, and the constant din of their rhythmic notes gave volume to the grand chorus of varied voices that were ringing in our ears. And last but not least, among all this great concourse of bird life, was the subject of this sketch, the black tern, flitting hither and thither, one of the most active and the most restless of the throng.

Nesting.—Among all the water birds of the middle west I suppose the black tern is the most widely distributed, the most universally common and the most characteristic summer resident of the sloughs, marshes, and wet meadows of the plains. The center of its abundance seems to be in the great, flat marsh country of Manitoba, where we found it everywhere the commonest and most conspicuous water bird in the extensive cane swamps about Lake Winnipegosis and Waterhen Lake, breeding anywhere in wet marshy situations. In the tall, thick growth of canes (*Phragmites communis*) their nests were widely scattered and hard to find, but wherever the canes were beaten down or partially open they had placed their frail nests on the dead and fallen canes of the previous year's growth, and about the little open marshy ponds we found them nesting in small colonies. If we did not find the nests it was not through any fault of the terns, for they did the best they could to show us by their actions where their treasures were hidden. There are few birds that are bolder, more solicitous or more aggressive than these little terns in the defense of their eggs, and even before the eggs are laid they will indicate by their actions the exact locality they have chosen. The short, sharp notes of protest come thicker and faster, as the intruder approaches, and when he is fairly among them their cries are prolonged into hard, shrill, angry screams, as the excited terns dart down upon his head, striking him again and again if he does not retreat. By making use of this telltale habit we were able to locate a number of nests in the hidden recesses of the tall canes, where they were sufficiently open for the bird to drop down upon the nest from above or to rise from it without becoming entangled in the canes. Some of these nests were quite elaborate and well made, resembling miniature nests of Forster's terns or Franklin's gulls, but more often they consisted of a few pieces of dead canes or reeds loosely arranged, and sometimes the eggs were laid in a mere depression in the prostrate and closely matted vegetation. In one little open slough hole we found four nests within a radius of 5 yards, but this is closer than they are usually placed. One of these was on the edge of a large muskrat house, just above the water level, and another was built on the remains of an old submerged muskrat nest.

In North Dakota in 1901 we found small colonies of black terns nesting in open situations in the sloughs, where the water was 1 or 2 feet deep and where numerous little piles of dead and partially rotted reeds and flags were floating. The nests were usually very flimsy affairs, a few loosely arranged bits of reeds and flags serving to raise the eggs an inch or so above the water. Often the eggs were laid in slight depressions in this floating rubbish, with no apparent attempt at nest building, where the eggs were wet and nearly awash. In Saskatchewan we found a small colony on June 24, 1906, breeding in a wet, grassy meadow where the water was only a few inches deep. The nests all contained fresh eggs and were merely small piles of rubbish floating among the scattered growth of short green meadow grass. I have several sets of eggs in my collection, taken by Mr. Gerald B. Thomas in Livermore, Iowa, during the last week in July. The nests were located in sunken muskrat houses, old grebe nests, and an old coot nest. Nests of the black tern often have substantial foundations of water mosses and other soft vegetable substances, which some writers seem to think are built by the birds. I think, however, that the black tern never gathers any such materials and that these foundations are either old grebes' nests, or merely floating masses of muck, selected by the terns, on which only the superstructure of the nest is built by them.

Mr. J. C. Knox (1899), who has seen the nest-building process, gives the following account of it:

> I had always before believed that the black tern merely hollowed out a nest on a bog and deposited her eggs there, but I was now undeceived. As I was walking along I happened to glance upward and saw a black tern with something in her bill. She was coming directly toward me, so I dropped down out of sight in a clump of green rushes. Just in front of me was the remains of an old muskrat house, now little more than a bog—a capital place for a tern's nest. Here she alighted and deposited her weed stem on the edge of a little hollow near one edge of the bog; then she flew away again, but soon returned with another weed and deposited that. I watched her for half an hour, and during that time she made 14 trips to the nest, bringing material each time, and twice her mate came with her. When I left the nest was not completed, but I think she had quit nest building for that morning. Many of the eggs of this species are laid on a bare bog, with no nest at all, but in this instance a nest was made and the materials, which could have been had directly at hand, were brought from a distance.

Occasionally nests of this species are placed on pieces of driftwood or boards where they are very conspicuous, but usually they are very hard to see, as both nests and eggs match their surroundings perfectly.

Eggs.—The eggs of the black tern are very handsome and are subject to considerable variation. Many of these resemble the eggs of some of the Limicolae, as they are often somewhat pointed. The average shape is ovate, with a decided tendency in some specimens toward ovate pyriform. The shell is thin and has a dull luster.

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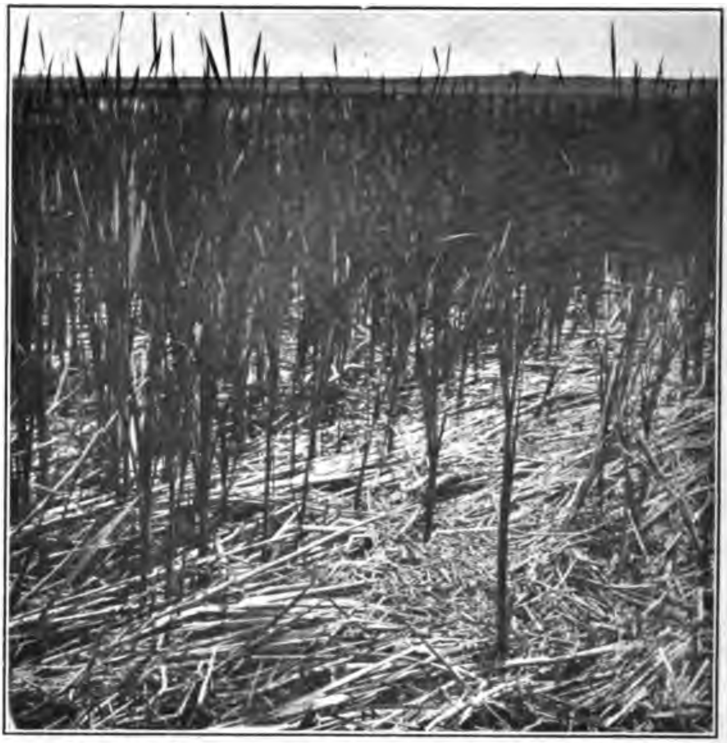
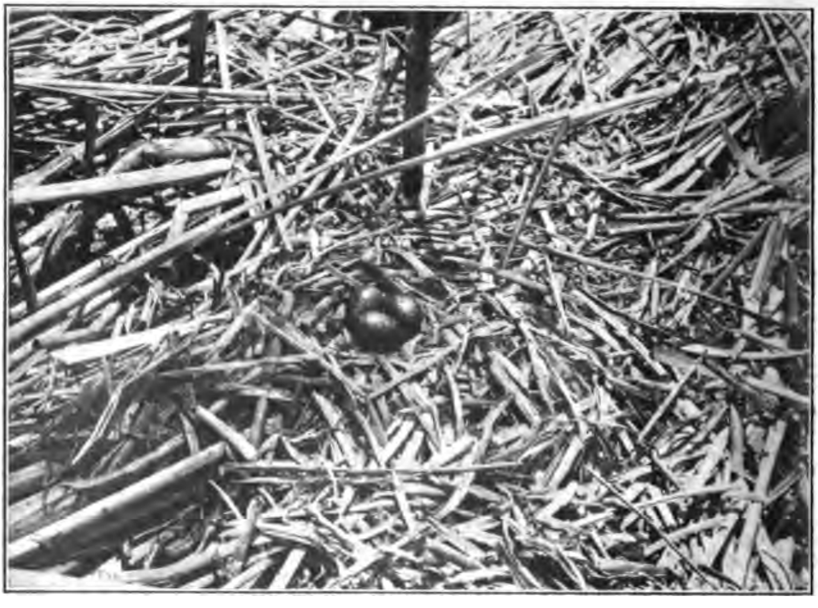


Barr Lake, Colorado. R. B. Rockwell.



Barr Lake, Colorado. R. B. Rockwell.

BLACK TERN.

FOR DESCRIPTION SEE PAGE 336.

The ground color shows a great variety of shades of olive and buff, from "Dresden brown" to "clay color," and from "deep olive buff" to "ivory yellow." The eggs are usually heavily marked with the darkest shades of brown, "blackish brown," "seal brown," "bister," and "mummy brown;" sometimes the eggs are evenly sprinkled all over with fine dots, but more often with larger spots and blotches unevenly arranged. Frequently the markings, of either type, become confluent in a ring around the larger end of the egg, and occasionally large bold markings of different shades of brown produce handsome effects. The measurements of 122 eggs, in the United States National Museum, average 34 by 24 millimeters; the eggs showing the four extremes measure 37 by 25.5, 35.5 by 26.5, 31.5 by 23 and 32 by 22.5 millimeters.

In the southern portions of its range the black tern apparently raises two broods, at least occasionally, for fresh eggs are frequently found in May and again in July. As very few, if any, of the water birds raise two broods in a season, it may be that these late sets may be second or third layings of pairs previously robbed of their eggs. Some good observers, however, seem to think that two broods are regularly raised in some localities. The full set is almost always three eggs, occasionally two, and very rarely four or even five. Personally I have never seen a set of four eggs, and think it is an exceedingly rare occurrence. Smaller sets than these are probably second layings. Dr. E. W. Nelson, according to Dr. T. S. Roberts (1877), says:

> I have seen the eggs of *Sterna plumbea* deposited on masses of floating weeds in several instances, but only for the *third* brood, the bird having previously built two nests and deposited the eggs in both, which had been removed by myself to ascertain how many they would lay. The result was almost invariably as follows: First nest, three eggs; second nest, two eggs; and the third, one egg.

Dr. Frank M. Chapman (1904) has learned that the period of incubation is 17 days. Audubon (1840) states that both sexes incubate—a difficult matter to determine, as a black tern is seldom seen on its nest.

Young.—The young remain in the nest but a few days, and even before that time they will leave it on the approach of danger. Doctor Chapman (1904) gives an interesting illustration of this in his account of the home life of this species. He says:

> Three days later we visited the nest, expecting to see a pair of downy young, but, to our surprise and disappointment, it was deserted. Evidently, however, there was something not far away in which the terns were greatly concerned. With piercing screams they darted at us, once actually hitting Mr. Seton's hat.

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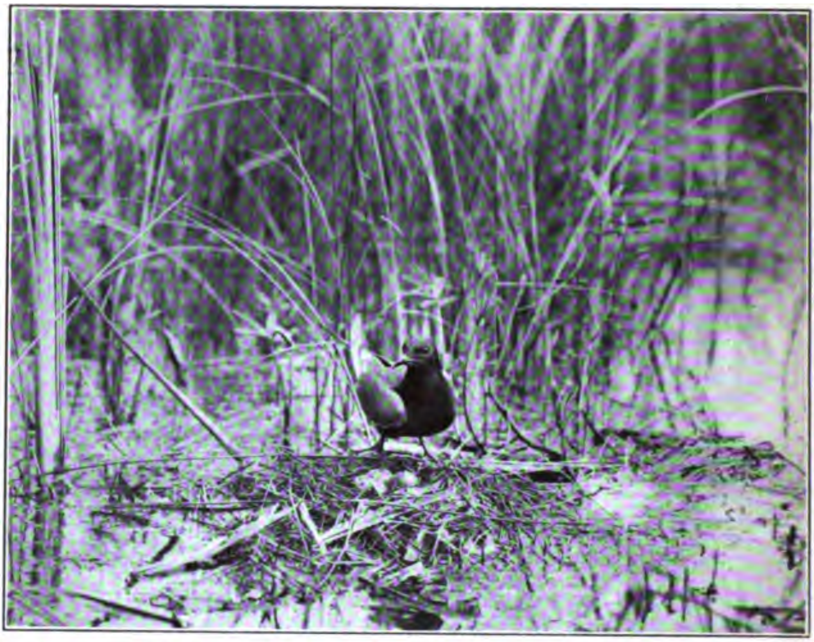
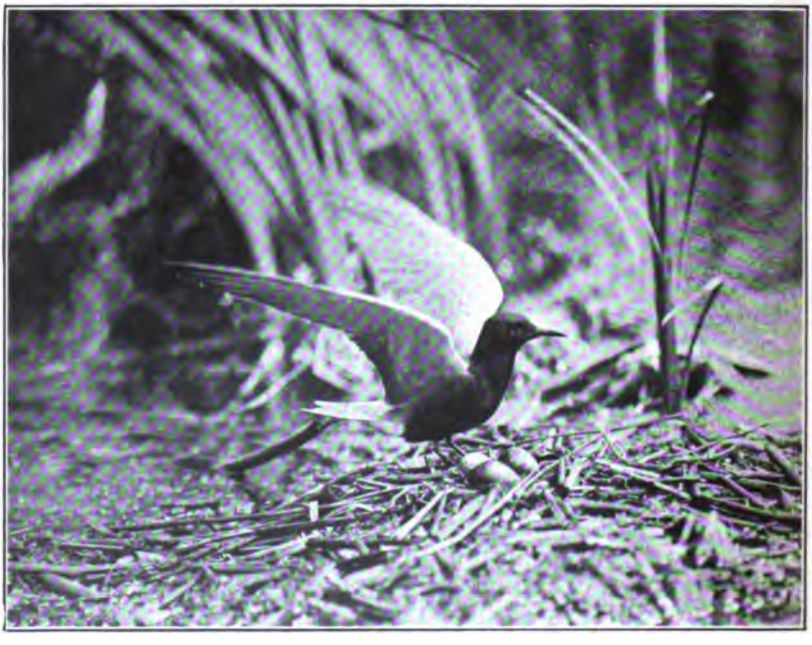


Minneapolis, Minnesota. Jenness Richardson



Minneapolis, Minnesota. Jenness Richardson.

BLACK TERN.

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on the throat, neck, and sides, shading off to "pale drab gray" on the belly and cheeks; the upper parts are rich "cinnamon," heavily blotched with "fuscous black." When very young the sides of the head, including the orbital region, the cheeks, the lores, and sometimes a narrow frontal strip, are pure white. This feature becomes less conspicuous as the bird grows older. As the bird attains its full size the down is gradually replaced with feathers, beginning on the wings, scapulars, and the sides of the breast; but much of the cinnamon down remains on the head, neck, and crissum until the juvenal plumage replaces it at the flight stage in July.

By the time that the young bird has attained its full growth the juvenal plumage has been fully acquired and the flight stage reached. This plumage is worn through August and September, and perhaps later. The upper parts are decidedly brown and often the under parts are extensively washed with brownish, dusky, or drab on the sides of the neck and chest, on the flanks and sometimes on the entire belly. The feathers of the back and scapulars are broadly margined with "clove brown" and narrowly tipped with whitish. The forehead is dirty white, the crown and occiput are mainly black, and the auriculars, as well as a ring around the eye, are pure black. The browns gradually fade and the light edgings wear away during the fall, but there is probably also a partial postjuvenal molt of the contour feathers. The first winter plumage is then much like the adult, but young birds can be recognized by having smaller bills, more or less signs of light edgings in the wing-coverts and back, and tails which are much less deeply forked, the lateral rectrices being broader and more rounded at the tips. I have not been able to trace very clearly the first prenuptial molt, but apparently a majority of the young birds acquire at this molt a plumage which is exactly or nearly like the adult nuptial, with more or less white in the black areas. Many birds, however, seem to wear the first winter plumage or a new one closely resembling it, until the first postnuptial molt, which occurs in June and July. This molt produces the adult winter plumage.

Adults have two complete molts—the prenuptial early in the spring and the postnuptial in July, August, and September. The seasonal change is very striking. In the winter plumage the forehead, a nuchal collar, and the entire under parts are white; the auriculars and a narrow orbital space are black; the crown and occiput are mottled with gray and black; and the mantle, wings, and tail are much lighter gray than in the spring—"light neutral gray" or paler.

Food.—The black tern is credited with eating minnows or other small fry, but I believe that it rarely does so except when associated with other terns on the coast. Mr. William Brewster (1878) says of their feeding habits in Massachusetts:

> They associated most commonly with the Wilson's and roseate terns, and procured their food in the same way, hovering over the schools of bluefish and pouncing upon the small fry which these voracious creatures drove to the surface. The stomachs of all the specimens which were dissected contained the macerated remains of small fishes only. In no case were any insects detected.

My own experience with the bird in this State is somewhat different, for I have seen large numbers of them hovering over the meadows and grassy marshes, catching insects in the air and darting down to pick them off the tall waving grasses, just as they do in the western sloughs. I have also seen them feeding with the common terns, but I believe that they prefer insect food when they can find it. In the interior the black tern is almost wholly insectivorous; its food includes crayfish, small mollusks, dragon flies, moths, grasshoppers, crickets, beetles, spiders, water scorpions, flies, and a great variety of other insects, nearly all of which are caught on the wing. Dr. R. M. Anderson (1907) says:

> They evince little fear of man, and large numbers will often follow a man plowing, hovering over his head and looking for grubs turned up by the plow. They are often killed with a whip at such times.

In the South it has been seen capturing the moths of the cottonboll worm in flight over the fields of young plants. Its ability to catch dragon flies, one of the swiftest of insects, is sufficient proof that the black tern is an expert flycatcher. Mr. Ernest E. Thompson (1890) says in regard to this performance:

> Besides aquatic insects, the black tern feeds largely on dragon flies, which it adroitly captures on the wing. The bird may frequently be seen dashing about in a zigzag manner so swiftly the eye can offer no explanation of its motive until, on the resumption of its ordinary flights, a large dragon fly is seen hanging from its bill and sufficiently accounts for the erratic movements of the bird. After having captured its prey in this way I have frequently seen a tern apparently playing with its victim, letting it go and catching it again, or, if it is unable to fly, dropping it, and darting under it to seize it again and again before it touches the water.

I have watched black terns for hours beating the air over the western sloughs, dipping down frequently to pick up some small morsel of insect food from the surface of the water, but I have never seen them plunge into the water, as they would do if they were after minnows. They glean much of their food from the tall, waving grasses, reeds, flags, and bullrushes. Their eyes must be very keen to find the small insects and spiders which crawl up the stalks to hide, and they are certainly expert at swooping down and catching them. At certain times, especially when it is blowing hard or raining, countless millions of mosquitoes, flies, small dragon flies, and other small insects seek shelter on the lee sides of the reeds, which means a bountiful harvest for the terns.

Behavior.—The black tern is a restless waif of the air, flitting about hither and thither with a wayward, desultory flight, light and buoyant as a butterfly. Its darting zigzag flight as it mounts into the air to chase a fluttering moth is suggestion of a flycatcher or a nighthawk; as it skims swiftly over the surface of the water it reminds me of a swallow; and its true relationship to the terns is shown as it hovers along over the billowy tops of a great sea of tall waving grass, dipping down occasionally to snatch an insect from the slender, swaying tops. When looking for food the bill is usually pointed downward, but in ordinary flight it points forward. Mr. Thompson (1890) made some calculations as to the speed at which this tern flies and arrived at the following conclusions:

> A large number of observations resulted in an average of three wing beats per second, with the greatest of regularity; another series of observations, not so satisfactory, allowed a distance of 5 yards to be traversed at each beat. This gave only the disappointing rate of something over 30 miles per hour, but this was at the uncertain foraging flight. Once the mother tern has secured her load of provender a great change takes place, as already mentioned. She rises high in air, and I am sure she doubles her former rate of speed, and straight as a ray of light makes for home. It is said that many birds can not fly with the wind; not so the tern; for now, if there be a gale blowing her way, she mounts it like a steed and adds its swiftness to her own, till she seems to glance across the sky, and vanishes in the distance with a speed that would leave far behind even the eagle, so long the symbol of all that was dashing and swift.

The ordinary call note of the black tern, given in flight when not particularly disturbed, is a short, sharp, shrill, metallic "*krik.*" When much excited this is prolonged into a shrill scream like "*kreek*" or "*craik,*" given with ear-piercing vehemence when attacking an intruder near its nest. Mr. Henninger, according to Doctor Chapman (1904), contributed the following interpretation of the notes:

> Call note, "*kleed*"; note of anger and anxiety, "*karr krr*"; ordinary note heard while on the wing, "*gik.*"

Doctor Chapman described the note used to call the young as a soft "*wheent-wheent-wheent.*"

With all the varied inhabitants of the sloughs, its bird neighbors, the black tern seems to live in peace and harmony. I have never known it to molest the eggs or young of other species, or to attack the adults, nor can I find in print any evidence of its hostility. It is not as sociable as some other species, and its nests are usually somewhat apart from others. As a species it is sociable and gregarious to a limited extent, and it shares with other terns the habit of gathering in flocks to hover over a fallen companion.

Fall.—By the middle or last of August, when the young birds have acquired their first winter plumage and most of the adults have completed their molt, the fall migration begins in a leisurely way, as the birds are in no hurry to reach their winter homes. Their wanderings are more extended at this season and more erratic. Generally a few, and sometimes large numbers, of black terns, mostly in immature plumage, are seen on the Atlantic coast from New England southward, sometimes in large flocks by themselves frequenting the marshes and wet meadows, but more often in small numbers mingled with other terns and gulls along the coast. Rev. M. B. Townsend writes to me that he has seen black terns flying over the waters of the Gulf of Mexico as early as August 1, some of which were still in full spring plumage, some were molting, and some had completed the molt into winter plumage. On June 16, 1910, while cruising off the coast of Louisiana, I saw a large number of black terns in small flocks; I counted 10 of them sitting on a stick of drift timber, equally spaced about a foot apart. They evidently thought that there was no more standing room, for they would not allow another bird to alight on the log, although several tried to do so. Capt. W. M. Sprinkle told me that they breed in the West Indies in February, appear here early in May, and remain all summer. I am more inclined to think that these were nonbreeding birds which failed to migrate northward in the spring.

DISTRIBUTION.

Breeding range.—Interior of North America. East to eastern Ontario (Kingston and Charleston Lake) and west central New York (Cayuga Lake). South to northern Ohio (Sandusky), northern Indiana (English Lake), northern Illinois (Cook, Putnam, and Henry Counties), central Iowa (Hamilton County), northern Nebraska (Holt and Cherry Counties), north central Colorado (Barr Lake region), north central Utah (Utah Lake), western Nevada (Washoe Lake), and southern California (Elsinore Lake). West to central California (San Joaquin and Sacramento Valleys), central southern Oregon (Klamath Lakes), east central Washington (Brook Lake), and central British Columbia (Chilcotin). North in the interior to central Alaska (Fort Yukon), Great Slave Lake, and central Manitoba (Lake Winnipegosis and Lake Winnipeg).

Breeding grounds protected in the following national reservations: In Oregon, Klamath Lake, and Malheur Lake.

Winter range.—From the Gulf of Mexico southward to northern South America (Surinam), and along the Pacific coasts of Mexico (Mazatlan), Panama, Peru, and Chile. Nonbreeding and young birds remain in the Gulf of Mexico all summer.

Spring migration.—A few birds migrate up the Atlantic coast and across the Great Lakes to the interior. Transient dates: Maryland, May 17 to 30; Pennsylvania, Erie, April 27; New York, Carmel, April 9; Massachusetts, Framingham, June 20; New Hampshire, Lake Winnipesaukee, June 10. The main flight is northward through the interior. Early dates of arrival: Missouri, St. Louis, April 29; Iowa, Floyd County, March 28; Wisconsin, Mayville, March 22; Minnesota, Heron Lake, May 1; Manitoba, Oak Lake, May 17; Great Slave Lake, Fort Resolution, June 5.

Fall migration.—Eastward, at irregular intervals, to the Atlantic coast from Nova Scotia southward and then down the coast to its winter range. Transient dates: Prince Edward Island, September 13; Nova Scotia, Sable Island, September 9; Massachusetts, August 7 to September 26; New Jersey, August 4 to October 20; North Carolina, July 28 to September 23; Florida, Tarpon Springs, September 15. Transient dates for the interior: Nebraska, August 8 to October 15; Kansas, July 25 to September 14; Missouri, up to October 21. Pacific coast dates: British Columbia, Sumas, up to September 1; Washington, Bellingham Bay, up to August 26; California, Point Pinos, August 2 to September 23; Lower California, San José del Cabo, September 6 and 7, and Cape San Lucas, September 16; Mexico, Mazatlan, arrives in October.

Casual records.—Accidental in Bermuda (October, 1876). The more northern Atlantic coast records might be classed as casual.

Egg dates.—Minnesota and North Dakota: Thirty-six records, May 25 to August 4; eighteen records, June 5 to 13. California: Twenty-six records, May 11 to July 2; thirteen records, May 19 to June 8. Illinois and Iowa: Twenty-four records, May 11 to July 28; twelve records, June 6 to 18. Manitoba and Saskatchewan: Nineteen records, May 28 to July 5; ten records, June 6 to 14.

CHLIDONIAS LEUCOPTERA (Temminck).

WHITE-WINGED BLACK TERN.

HABITS.

The following quotation from Kumlien and Hollister (1903) contains all we know of this beautiful Old World species as a bird of the North American Continent:

> The only known instance of the occurrence of this species on the Western Continent is that of a breeding female shot by L. Kumlien in a large marsh near Black Hawk Island, Lake Koshkonong, July 5, 1873. The specimen was sent freshly skinned to Doctor Brewer and was presented by him to the United States National Museum. The partially denuded abdomen and well-formed ova prove that it would have bred, whether with its own kind or with the common species we know not, as no others were seen at the time nor since,

although days have been spent in the tern colonies for almost no other purpose than the vain hope of seeing more of them. The bird was quite noticeable among the enormous numbers of black terns; so much so that there is no special need for any one to sacrifice the life of any of the common species under the delusion that it may prove to be *leucoptera* when in hand.

Nesting.—Yarrell (1871) says:

> The white-winged black tern nests in marshes, sometimes in company with the black tern, where, as in Central Europe the latter preponderates, but in large colonies of its own in southeastern Russia and Siberia, where it is the dominant species. Its eggs, deposited on the floating vegetation in May and June, are usually three in number, of an olivaceous-buff, boldly blotched, and streaked with dark brown, and spotted with gray of different shades. Average measurements about 1.35 by 1 inch.

Eggs.—Morris (1903) states:

> They arrive at their summer haunts in the month of May and disappear in July and August. The eggs of this species are three or four in number, with many grayish spots, and some larger blackish red ones, the ground color being dull yellowish olive. They are of a rotund form. The male and female birds sit on them in turn and show much anxiety for their safety, flying at and about all intruders.

The eggs of this species seem to be indistinguishable from those of the common black tern. The measurements of 42 eggs, in various collections, averaged 34.9 by 24.9 millimeters; the eggs showing the four extremes measure **37** by 25.1, 35 by **26**, **32.5** by 24.4 and 33.5 by **23** millimeters.

Plumages.—Yarrell (1871) describes the plumage changes as follows:

> The nestling is of a nearly uniform rufous-buff, slightly darker on the throat; the crown and back streaked and mottled with blackish-brown. The immature bird in August has the bill livid brown; lores and forehead white; crown and nape brownish-gray; a dark streak behind the ear-coverts. Sides of the neck white, tinted with buff; upper back and scapulars slate-gray, tipped or overlaid with brown, which gradually wears off; back gray, mottled with brown, rump white, passing to gray on the tail-coverts; tail feathers gray, darker and browner at tips; primaries darker on inner webs than in the adults; under wing-coverts and under parts white. By the end of the following summer the brown tips have completely passed away, leaving only a mottled bar along the carpals to indicate immaturity; and in the following spring, when the bird is nearly 2 years old, it assumes the black nuptial garb. The tail feathers, however, do not become quite white for some years, and it may be that this takes longer with the females than with the males; otherwise there appear to be no appreciable external differences between the sexes when fully matured. In the autumn molt the black portions of the plumage become white on the head, neck, and underparts, and slate-gray on the mantle. A specimen in the editor's collection, obtained near Valencia, in Spain, on the 25th of July, presents a remarkably piebald appearance. Some black is never absent from the nape and ear coverts, and in mature and vigorous birds the black of the under parts soon begins to make its reappearance.

Food.—Macgillivray (1852) says:

> It is said to feed chiefly on aquatic insects and worms, especially dragonflies, moths, and other winged insects, seldom on fishes.

Yarrell (1871) adds "the larvae of water insects," and Morris (1903) includes "the fry of fish."

Behavior.—Yarrell (1871) says:

> In its flight it is more rapid than the black tern, and it is said to have a louder and harsher voice than that species.

Evidently it is closely related to the black tern, and apparently a detailed account of its life history would agree very closely with what we know of our own familiar bird of the western sloughs.

DISTRIBUTION.

Breeding range.—Central and southeastern Europe from central Russia southward, also westward in Galicia, Hungary, and occasionally Bavaria; in Asia, across Siberia to the Amur Valley and southward to Turkestan; in Africa, said to breed in Algeria. The Australian bird has been separated as a distinct subspecies.

Winter range.—In Africa, south to Cape Colony; in southern Asia and south to Australia and New Zealand.

Casual records.—Accidental in Denmark, Sweden, and Great Britain. Taken once in West Indies (Barbados, October 24, 1888) and once in Wisconsin (Lake Koshkonong, July 5, 1873).

Egg dates.—Central Europe: Twenty records, May 17 to June 14; ten records, May 28 to June 9.

ANOUS STOLIDUS (Linnaeus).

NODDY.

HABITS.

This dusky tropical species enjoys a wide distribution on both sides of the Equator in both of our great oceans, and shows so little geographical variation that our Atlantic and Pacific birds are scarcely separable. It resorts to many different islands throughout its range to breed, and its nesting habits vary considerably in different localities. Although much has been published regarding its habits during the breeding season we know very little about its life history at other seasons.

Spring.—Mr. W. E. D. Scott (1891) has published some interesting notes by Mr. Charles B. Taylor, regarding the arrival of the noddies on Morant Cays, near Jamaica, from which I quote, as follows:

> At the time of my arrival at the Cays (2d of April) there were no sooty terns there and very few noddies, but these latter increased in numbers daily, until by the 10th of April, the date of my departure, they had assembled in

hundreds and were evidently preparing to lay, yet in two females taken two or three days after my arrival the eggs in the ovaries were very small.

Soon after sunset the birds came in to roost among the low bushes fringing the shore, and up to a late hour many kept arriving. They flew very swiftly, just skimming the surface of the water, and standing on the shore at dusk (the time they began to arrive) it was rarely possible to see the birds coming until they were actually on the island. They alighted noiselessly and instantly on gaining the fringing bushes; later in the month, however, as their numbers increased, belated birds found difficulty in effecting an easy landing among the branches, those already in possession pecking right and left at all newcomers and croaking harshly. Each day, as their numbers increased, they became more vociferous, until at last the melancholy wail of those flying overhead and the croak of the sitting birds was kept up without intermission all through the night. On moonlight nights they appeared unusually abundant and restless.

I have watched them there until far into the night, as in scores they kept flying to and from the bushes. Although up and about before dawn on most mornings, I was seldom in time to watch the noddies leave their roost. One morning, however, I got a good idea of their numbers. It wanted about an hour or so of daybreak, and the moon was still bright, when someone walking along the shore appeared to give a general alarm. Scores of birds got up and went swiftly out to sea, and for some little time a constant stream poured out from the bushes along the shores in every direction, as far as it was possible to see; flying before the wind, they went out of sight in an instant. They left the land always in the same manner in which they came in to roost, dropping to the surface of the water immediately on clearing the shore. Notwithstanding their apparent abundance, the noddies, in point of numbers, sink into comparative insignificance after the arrival of the sooty terns.

Prof. John B. Watson (1908) has made a most thorough and scientific study of the behavior of this species and the sooty tern on their famous breeding grounds in the Dry Tortugas and I shall quote freely from the published results of his observations. He describes the island on which they nest as follows:

Bird Key is a small coral island about 300 yards wide (east and west) by 400 yards long (north and south). It is 65.8 statute miles due west from Key West. The island is partially sheltered on the east and on the northeast by a coral reef. Northeast of the island, about 1.125 statute miles distant, stands Fort Jefferson, now practically deserted. Still farther to the northeast other low coral islands are to be found. Loggerhead Key lies about 4 statute miles to the west of Bird Key. Immediately outside of these islands is to be found the water of the Gulf of Mexico. The situation of the island shows that it is adequately protected from all but the severest southwest storms. The Tortugas as a whole are rarely subject to heavy storms during the nesting period of the birds. During the past season (1907) only one severe storm visited the island, and this was not very destructive to the life of the birds.

Owing to its juxta-tropical location, its slight elevation, and the condition of its surface (largely coral sand) the actual surface temperature of this island is very high, ranging at times during the hottest days from 124° to 143° F.

With the exception of the bay-cedar bushes, which are very abundant upon the central and western parts of this island, little vegetation exists. On a certain limited portion of its surface (southeastern) a dense growth of cactus is to be found. Both cactus and bay cedars are utilized by the noddies for nesting places.

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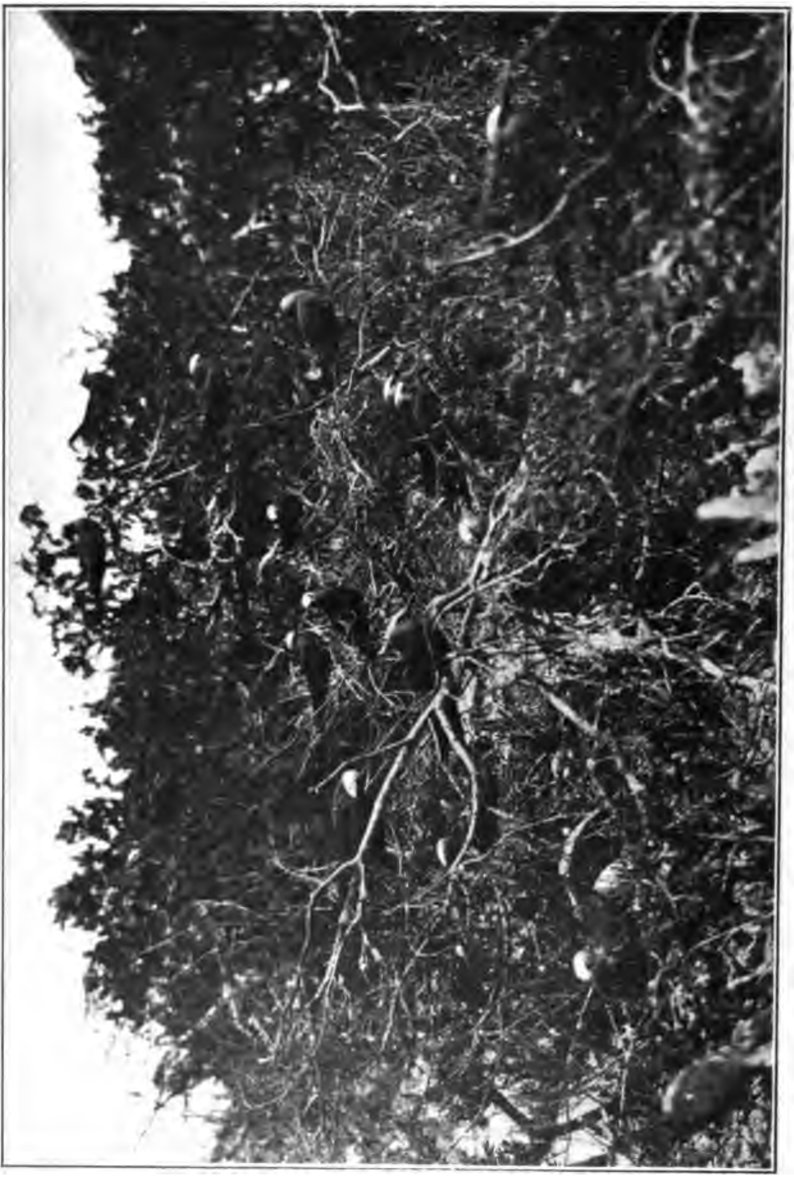

Dry Tortugas, Florida.

NODDY.

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> No accurate data exist concerning the number of years these two species have migrated to this island for the purpose of rearing their young. The oldest inhabitants of the neighborhood say that as long as they can remember the birds have been going there year after year. The terns arrive at approximately the same time each year (during the last week in April), live there until toward the 1st of September, and then begin their southern migration.

Courtship.—The birds are said to be mated before they arrive on the island, and, as he did not arrive until five days later than the birds, Prof. Watson was unable to observe their earlier actions; but he tentatively presents the following account of what is probably a mating performance:

> One day I observed several noddies "sunning" upon the wire covering of one of my large experimental cages. Suddenly, one of the birds (male) began nodding and bowing to a bird standing near (female). The female gave immediate attention and began efforts to extract fish from the throat of the male. The male would first make efforts to disgorge, then put the tip of the beak almost to the ground and incline it to the angle most suitable to admit her beak. She would then thrust her beak into his (the ordinary feeding reaction). The feeding reaction was alternated with the nodding. After this series of acts had been repeated 20 times the male flew off and brought a stick. He deposited this near the female and then again offered to feed her. She again tried to feed; then the male attempted sexual relations. She immediately flew away, but almost immediately returned and alighted at a slightly different place. The male again brought the stick and again bowed and offered to feed her. She accepted the food, but again flew away when the male attempted to mount her. At this juncture the island was disturbed and my observations could not continue.

Nesting.—During his sojourn on Bird Key in 1907 he made an accurate count of the noddies' nests "by means of a mechanical counting device," which gave a total of 603 active nests. A large majority of the nests are built in the bay-cedar bushes at varying heights up to about 12 feet. About 20 per cent of them are in the cactus growth.

> Very often the nest has the appearance of being constructed directly upon the ground, but a closer examination usually shows that it has been built upon a tuft of grass or upon the stem of a bush, the branches of which have been broken off close to the ground. * * * The noddies apparently do not seek to nest in the thickest parts of the bushes. Although isolated nests are present even where the shrubs are most dense, by far the majority of them are to be found in bushes which border upon open spaces.

Of the construction of the nest he says:

> The noddy constructs its nest from (1) loose dead branches of the bay-cedar bushes; (2) of seaweed; (3) of a combination of these; (4) of a combination of either or both of these with various kinds of sea shells and coral. When the shells and coral are employed they are often placed as an inner lining to the nest and the egg is deposited directly upon them. The nest itself is a quite variable structure and usually loosely put together. It is very shallow, and this is rather singular, since the wind often blows the egg or the young to the ground.

> The nests remaining from year to year are utilized by the birds at successive nesting periods; whether or not by the same pair can not with certainty be answered at present. On account of this utilization of the old nest from year to year some of the oldest nests have grown to enormous size, due to the addition of new materials at each successive season.

Professor Watson (1908) made an interesting series of observations on the methods of nest building and the daily routine of activities during this period, but I shall attempt to quote only part of what he says about it:

> Both birds work, bringing sticks, seaweed, shells, and coral. Both birds shape the nest clumsily by pecking and pulling at the sticks. They never weave the sticks so as to form a compact and durable nest. The stick is dropped on the rim, then drawn into position. Frequently first one bird then the other sits in the nest and shapes it. In order to do this, the bird rises on its feet and depresses its breast and turns round and round. The material is obtained both far and near. Floating sticks and seaweed are gathered from the water. They frequently alight under the nests of other birds and gather up the fallen branches. They even take the material from other nests which are left momentarily unguarded. Frequent fights ensue. The birds work neither steadily nor rapidly; 10, 15, 20 minutes may elapse before either makes a trip.

The male feeds the female while she is building the nest, consequently it is necessary for him to cease from his labors in assisting her and absent himself in search of food. During his absence she also ceases her activities, but remains at the nest to guard it from her pilfering neighbors and to repel the advances of other males. On his return she is fed as follows:

> The male returns with a full-laden crop. He alights directly upon the nest or near the female. The female at once shows signs of life, and as they approach each other they beginning nodding. Then the male invites the female to feed by putting his beak down to a position convenient to her. She gets the food by taking it directly from the mouth of the male, the male disgorging it by successive muscular contractions of the throat and abdomen. The impression one gets from this ludicrous performance is that the bird is choking to death. During the whole of the process of feeding, a soft, nasal, rattling purr is emitted, presumably by the female. This purring sound is an invariable indication that feeding is taking place. It is to be heard on no other occasion.

Professor Watson (1908) noted the first eggs on May 4 and found that the majority were laid between the 11th and the 16th. He says further:

> After the egg is laid a marked change appears in the behavior of both the male and the female. The birds will now attack even a human intruder, and their defense of the nest against their own kind becomes even more strict than before. Oftentimes the birds will sit on the egg and allow themselves to be caught, striking viciously all the while with their long, keen, pointed beaks. Individuals vary greatly in this respect. On my daily rounds, as I approached the vicinity of a group of nests, several noddies would usually advance to meet me, striking viciously at my head. Their attacks would continue until I withdrew. Many times I have had my hat knocked off and the blood brought from my scalp by their vicious attacks.

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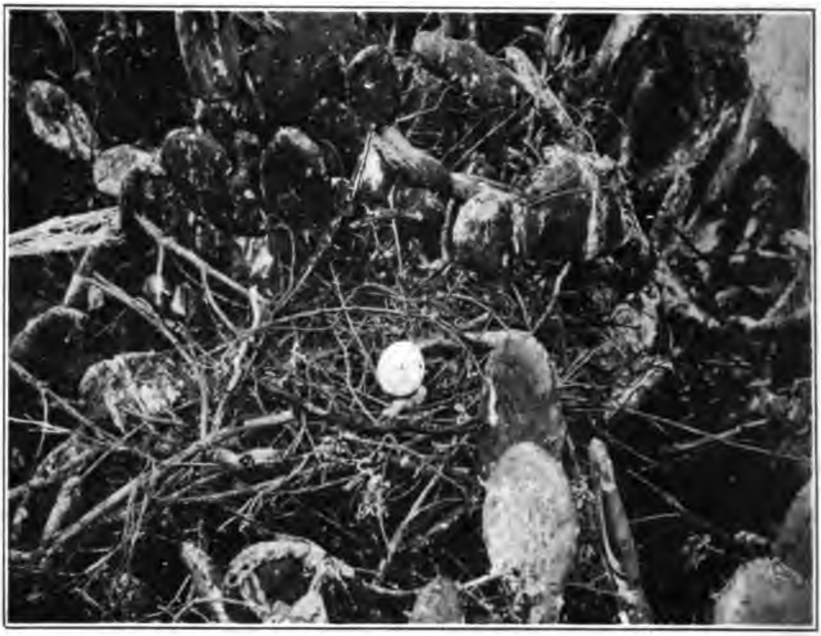
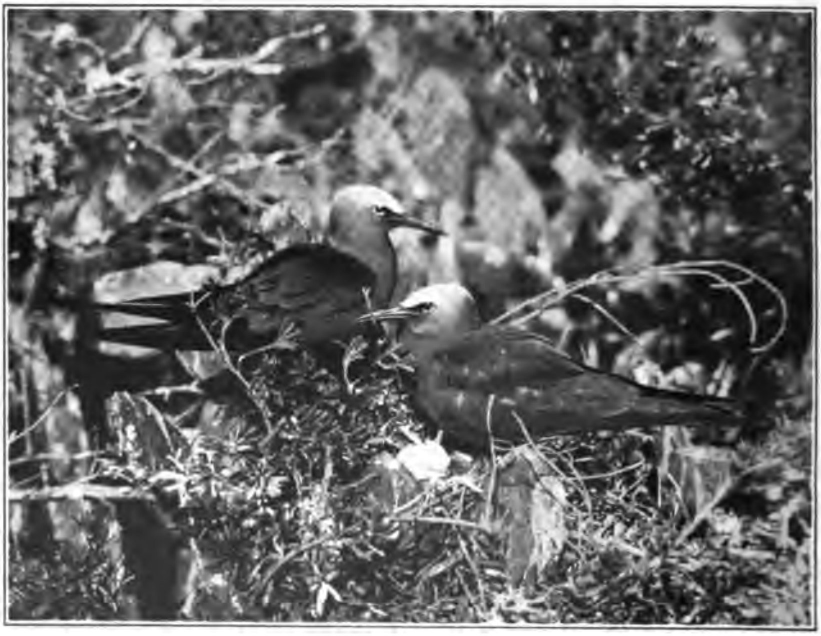


Dry Tortugas, Florida. H. K. Job.



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> Still another marked change occurs in the habits of the birds. The male no longer feeds the female. Each bird takes equal turns at brooding the egg. My attention was first called to this while I was watching the habits of the birds before the egg was laid. Several nests in the vicinity of the place of observation already contained eggs. At these nests I was never able to observe the feeding of the female by the male. At this period the two birds became practically automata. Their life is taken up in alternately brooding the egg and in feeding. The birds spend little or no time together except at night. The one comes to the nest; the other flies away to feed.
>
> The egg is generally covered day and night. Occasional trips are made to the water for drinking and for wetting the breast feathers. This latter reaction has its value possibly in keeping the egg at the proper temperature. The sun is so hot that if the egg were left uncovered for any great length of time it probably would not incubate.

The period of incubation is 35 or 36 days.

Professor Watson (1908) conducted some interesting experiments to test the ability of the birds to recognize their mates, their eggs, and their nests. Painting or dyeing the plumage disturbed them greatly and upset their powers of recognition, but they were "not at all affected by changing the hue, brightness, and markings" of the eggs, showing that the egg itself is not recognizable. The noddies were very much puzzled by moving the nest, which shows that it is not the nest that they recognize but its position.

After the young bird is hatched the parents are still more interested in defending the nest. "They will now attack with vigor other noddies which approach too near the nest—the sooties and the frigate birds." Both parents help in feeding the young coming alternately at intervals varying from two to four hours. Professor Watson (1908) further says:

> The young are cared for in the nest until they become strong enough to leave it and live upon the ground. The young birds born in low nests, even at a very early age (20 days and even earlier) clamber from them with alacrity and hide in near-by bushes when danger is imminent. In many cases these young birds can not get back into the nest. Under these circumstances they remain near the nest locality, and the parents on returning first alight on or near the nest and later hop to the ground and feed the young bird. It is interesting to speculate upon the method of recognition between parent and young. There can be no doubt at least of an accurate functional recognition. Since the noddy is always silent when contented, the evidence is good that recognition occurs wholly in terms of vision. Whether recognition of young (or of mate by mate) would take place outside of the nest locality is a problem which ought to be solved.

An entirely different method of nesting has been noted by several observers in the West Indies. Mr. George N. Lawrence (1864) published the following interesting notes made by Dr. A. A. Julien on the island of Sombrero:

> Their nests are of two kinds. For the first the noddy gathers together, by carrying in its bill, a considerable quantity of bits of shells, deposits them in a shallow cavity of the rock, say 8 to 12 inches in diameter, deepens a little the

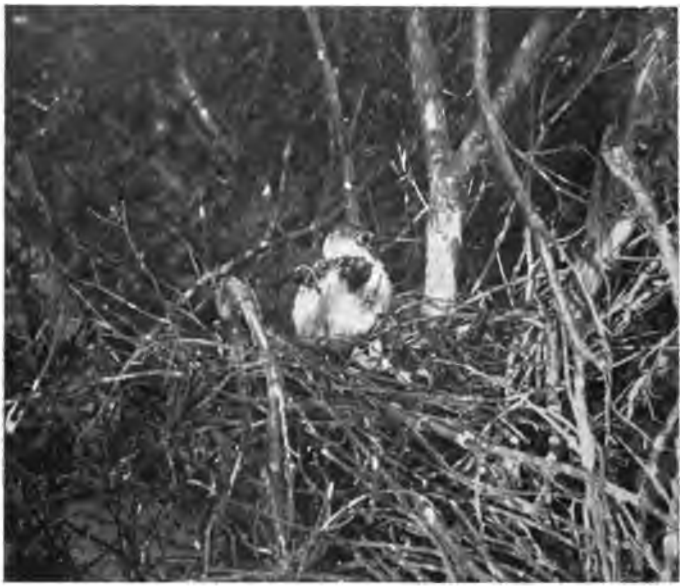
center of the basin, and thereon lays her egg. Occasionally such a nest is also encircled with a few twigs; sometimes it consists of over 50 pieces of shell but more frequently the shells and twigs are so scant that the egg lies upon the bare rock. The nests built in the crevices of the cliff, however, consist chiefly of twigs, though even these are frequently capped by a few bits of shell, upon which the egg immediately lies. The noddies are often thievish when building their nests; where two pair are thus engaged in close proximity, the one will often repeatedly carry off to their own nest from that of the other in their absence.

Eggs.—Although the noddy has been said to lay from two to three eggs in a set, such cases must be decidedly exceptional, for one egg only seems to be the almost invariable rule. If the egg is taken or destroyed it will soon be replaced by another, but evidently only one young bird is reared in a season by each pair of birds. The egg is ovate or slightly elliptical ovate in shape. The shell is thin, smooth, and without luster. The ground color varies but slightly, from "pale-pinkish buff" to "cartridge buff." It is sparingly spotted with small spots or dots, usually more thickly at the larger end, with at least two distinct colors. The underlying spots are of various pale shades of lilac or lavender and the overlying, more conspicuous, spots are of bright shades of deep reddish brown. Some of the brown spots seem to be superimposed over the lilac spots or blended with them. The eggs can be readily distinguished from those of the sooty tern by being much less heavily spotted. The measurements of 44 eggs, in the United States National Museum, average 52 by 35 millimeters; the eggs showing the four extremes measure 58 by 37, 54 by 37.5, 49.5 by 35.5 and 51 by 33 millimeters.

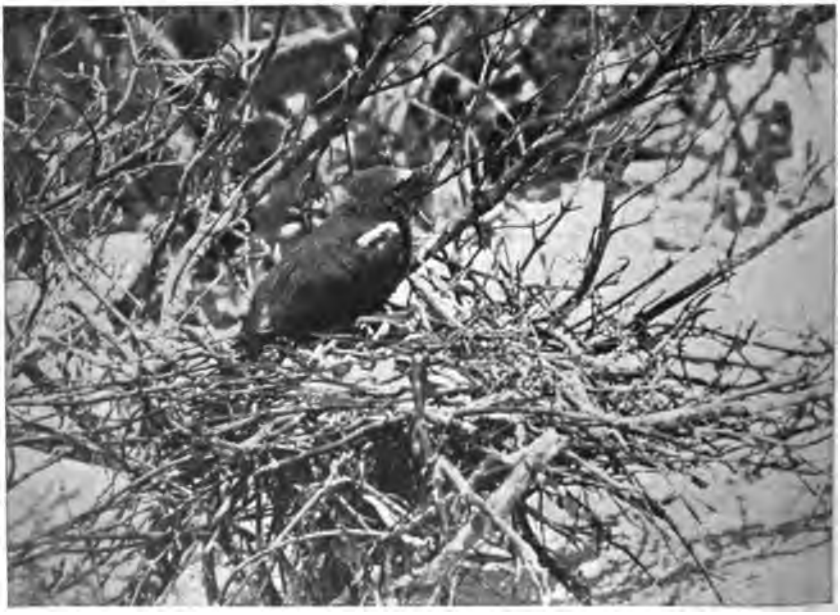
Young.—According to Professor Watson (1908):

> The young noddies began to appear on the island about June 9. The first few hours after birth they are extremely helpless. During the first day of their life they exhibit few signs of fear, making little effort to shrink away from the hand. * * * At the end of the first day the birds were able to stand fairly erect and to move their heads with some freedom. * * * They can not swim at the end of the first day. * * * The note of the young noddy is very different from the hoarse, rattling sound of the adult. It is a soft, liquid, slow, plaintive "querk-querk-querk." * * * It is absolutely imperative for them to have the free use of the head and eyes and to be able to stand erect and to peck during the first day. The feeding parent on returning alights near the young bird, puts down its beak, and successively touches and taps the beak of the young bird; then its part of the reaction is at an end, provided by successive disgorgements it keeps its beak and throat filled with small minnows. The young bird must stand up and strike the beak of the parent until the parent opens its beak sufficiently wide to admit the beak of the young bird. When the fish in the mouth of the parent come in contact with the buccal cavity of the young, the swallowing reflex follows perfectly.

He reared three young noddies, feeding them by hand, until they were 30 days old, and his detailed notes are well worth reading. On the fourth day they began to learn to swim; after the eleventh day



Dry Tortugas, Florida. Joseph Thompson.



Dry Tortugas, Florida. Joseph Thompson.

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they were able to eat food deposited near them, as the adult often disgorges the food on the rim of the nest. They also soon learn to keep the nest clean by forcing their fecal matter far out over the rim of the nest. At just what age they learn to fly he does not state.

Plumages.—The downy young seems to have two color phases—a dusky phase and a white phase. The only specimen that I have seen is sparingly covered with short, dirty white down, tinged with buffy, with signs of a few black feathers coming in on the center of the back, the wings, and the crown. Two of the specimens shown in Professor Watson's (1908) plate seem to be quite dusky. At an age of 18 days the young bird seems to be about half fledged, and at 30 days, practically fully feathered. This juvenal plumage much resembles that of the adult; it is "bone brown" above and "fuscous" below; the feathers of the back, scapulars, and wing-coverts are tipped with "wood brown," which fades later to buffy white; the pale gray cap is acquired and the throat is largely grayish white.

Yarrell (1871) says:

> In birds which are not fully mature the black loral streaks are less defined; the gray of the forehead and throat is less pronounced, and the general tint is browner. Birds of the first year have very little white on the forehead; the mantle and wing coverts are of a lighter brown, the secondaries and tail feathers showing slight bars of umber-brown near the tips; underparts pale brown.

As to subsequent molts we have very little data, but there seems to be no conspicuous seasonal change, except on the crown. In winter this is nearly as brown as the back, with only a narrow white supraloral line. The material examined seems to indicate a complete postnuptial molt and probably a complete prenuptial molt.

Food.—In regard to the feeding habits of these terns, Professor Watson (1908) says:

> In a locality where marine forms are so abundant as in this favored Gulf region, the terns collect their food with little difficulty. They feed upon small fish of different kinds, which are present in great abundance. Examination of the stomach contents of both young noddies and sooties showed the presence of representatives of the two families of fish Carangidae and Clupeidae.
>
> To my great surprise I found that the birds never swim nor dive. As a matter of fact, they never touch the water except when drinking or bathing. The bird drinks the seawater as it skims the surface of the water with open beak. Bathing they perform in much the same way, never coming to a stop in the water nor completely immersing the body; usually the breast and head are the only parts dipped into the water.
>
> The birds fish by following schools of minnows which are being attacked by larger fish. The minnow, in its efforts to escape, jumps out of the water and skims the surface for a short distance. The terns pick off these minnows as they hop up above and over the surface of the water. The rapidity and accuracy of visual-motor adjustment in this reaction is wonderful.
>
> The birds feed singly or in groups; usually in groups. The group may be composed of both noddies and sooties and may contain sometimes as many as

> 50 to 100 individuals. All during the day groups of noddies and sooties may be seen at work. As the minnows cease to jump above the surface of the water, the group disbands and scatters in every direction. An instant later, as an attack is made upon the minnows in some other locality, the birds immediately rush there and renew their feeding.

He also discovered that most of their fishing is done within 9 or 10 knots of the island, and that they seldom venture more than 15 knots away from it. Mr. B. S. Bowdish (1902) found in the stomach of a noddy "an entire flying fish about 4 inches long and remains of others.

Behavior.—Audubon (1840) writes of the flight of the noddy:

> The flight of this bird greatly resembles that of the nighthawk when passing over meadows or rivers. When about to alight on the water the noddy keeps its wings extended upward and touches it first with its feet. It swims with considerable buoyancy and grace, and at times immerses its head to seize on a fish. It does not see well by night, and it is perhaps for this reason that it frequently alights on the spars of vessels, where it sleeps so soundly that the seamen often catch them.

Dr. Frank M. Chapman (1908) gives a different impression of it. He says:

> As the only tern with a rounded, instead of forked tail, the noddy might be expected to differ in flight from other members of its family. In fact, it suggested, when in the air, a light-bodied, long-winged, long-tailed pigeon. They fly rapidly, never hovering with the sooties; and they were often seen pursuing each other high in the air in what were doubtless mating flights.

Professor Watson's (1908) interesting experiments show that the noddy is a swift and powerful flier, with strong powers of orientation. Birds which he transported and liberated at Key West, Cuba, and even Cape Hatteras returned directly and promptly to their breeding grounds in the Dry Tortugas. He says that in flying at night they "break their graceful flight into short, ungraceful, and ill-directed choppy swoops, very similar to the way the nighthawk breaks its flight when flying after dark."

In spite of the statement of some other writers to the contrary, Professor Watson (1908) says that these "birds never swim nor dive * * *. During my three months' stay I never saw one of these birds in the water, except by accident, and then the bird, if the tide is against it, can never reach the shore, so poorly does it swim."

Mr. Bowdish (1902) says that "the common note resembles the clamor of young crows, and is often heard, more or less, throughout the night." There has been so little published on this subject that I infer that the vocal performances of this species are not elaborate.

Of their behavior with relation to other species Professor Watson (1908) writes:

> From the writings of others I had drawn the conclusion that the frigate bird attacks the terns and forces them to disgorge, and that it feeds upon their young. I spent many weary hours in attempting to discover the relation of the frigate bird to the terns, especially its relation to the noddies. Since the noddies build their nests in the bushes where the frigate birds roost, it was presumed that there, if anywhere, the devouring tendency of the frigate bird ought to appear. I found that the cause of the disturbance between noddy and frigate bird lies chiefly in the fact that the latter, in attempting to find a bush in which to rest, sun, or roost, will oftentimes alight upon or very near to a noddy nest, whereupon the noddy most immediately concerned and those near by will attack the frigate bird, and at times even rout him. It is a common occurrence especially late in the afternoon when the frigate birds are returning to see hundreds of such fights. The noddy is always careful to attack the frigate birds by sudden thrusts (usually made from below), dodging quickly to avoid their fearful and powerful beaks.

Mr. Edward W. Gifford (1913) says:

> It was not uncommon to see a noddy sitting on the head of a brown pelican, while the latter was resting on the water swallowing fish. Once I saw two on a pelican's head at one time. Several often accompanied the young pelicans in their excursions along the coasts.

Gathering the eggs of this and other sea birds for food has long since been stopped in the Dry Tortugas by including the islands on which they breed in a reservation and by protecting them; but the practice still continues in the West Indies, where the eggs are considered a legitimate food supply and are gathered in large numbers.

Fall.—According to Dr. Joseph Thompson, United States Navy, (1903), "toward the end of September the birds begin to leave. They leave in great flocks and at night. The entire exodus consumes, apparently, but two or three days; and some morning the observer will find the island absolutely deserted, save for a few crippled birds that have been injured and are unable to follow their comrades." Just where they go or how they spend the winter months does not seem to be very well known. They are probably scattered widely along the tropical coast of South America and among the numerous islands inclosing the Caribbean Sea.

DISTRIBUTION.

Breeding range.—The Atlantic form breeds from the Florida Keys (Dry Tortugas) and the Bahamas (Atwood's and Gaulding's Keys, Dry and Booby Rocks, Acklin, and Berry Islands, etc.), eastward and southward throughout the West Indies (Cuba, Jamaica, Haiti, Porto Rico, Dominica, Carriacou, etc.), to Venezuela (Margarita Island). South in the Atlantic Ocean to St. Helena, Tristan da Cunha, and Ascension Islands. West to the coast of British Honduras (Glover's Reef and Cay Dolores). North, formerly and perhaps now, to southern Texas. Pacific birds are supposed to be subspecifically distinct and have been split into several subspecies.

Breeding grounds protected in the following national reservation: In Florida, Tortugas Keys.

Winter range.—Practically the same as the breeding range.

Casual records.—One record for Bermuda (September 12, 1884).

Egg dates.—Bahama Islands: Forty-three records, May 5 to July 1; twenty-two records, May 16 to June 2. West Indies and Florida: Ten records, February 17 to July 6; five records, May 20 to June 24.

Family RYNCHOPIDAE, Skimmers.

RYNCHOPS NIGRA Linnaeus.

BLACK SKIMMER.

HABITS.

The coasts of Virginia and the Carolinas are fringed with chains of low, sandy islands, many of them lying far out from the shores, with broad, flat, sandy beaches on the ocean side, and often on the inner side with extensive salt marshes which are intersected by numerous creeks and shallow estuaries. Although practically worthless for human occupancy, these islands form ideal resorts for several species of water birds and shore birds. Cobb's Island, undoubtedly the most famous and perhaps the most typical of this class of islands, has for many years been a popular resort for sportsmen and bird lovers, though its bird population has been sadly depleted during recent years. The countless thousands of least terns, which once enlivened its sandy shores, have all disappeared into the capacious maw of the millinery trade. The gull-billed terns have been nearly exterminated and the common terns much reduced in numbers by the same agency. Only a few nests of each are still to be found on the pebbly sand flats. The laughing gulls still breed in fair numbers on the salt marshes, but they are persistently robbed by egg-hunting fishermen, and the once populous breeding colonies of willets have been nearly annihilated by sportsmen, who shoot the local breeding birds as well as the migrants. Fortunately the black skimmers are not regarded as game birds and their plumage is not in demand for millinery purposes, so that they still frequent their favorite breeding grounds in large numbers.

When the rising tide flows in around the island, covering the outer sand bars, driving the birds from their low-tide roosting and feeding places and flooding the shallow estuaries, then the "flood gulls," as they are called, may be seen skimming over the muddy shallows, about the mouths of the creeks, or up into the narrow inlets, grace-

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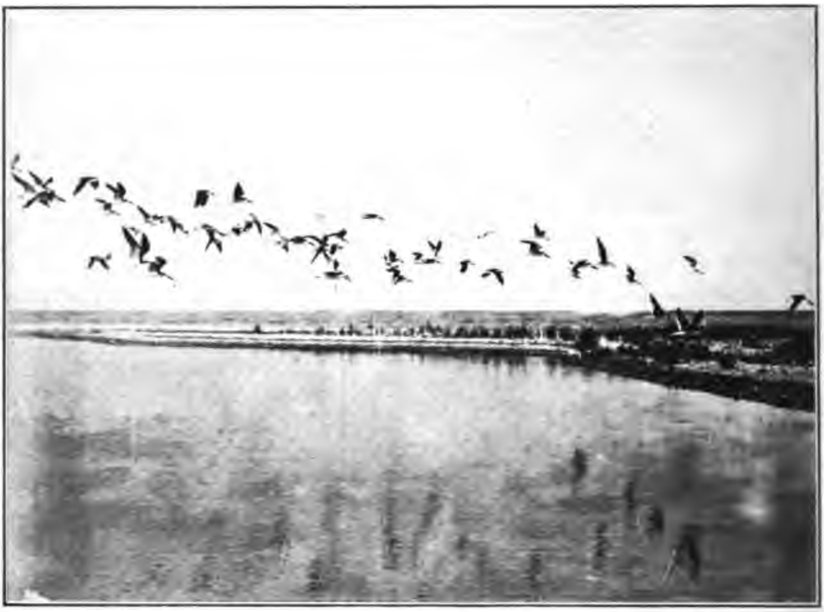
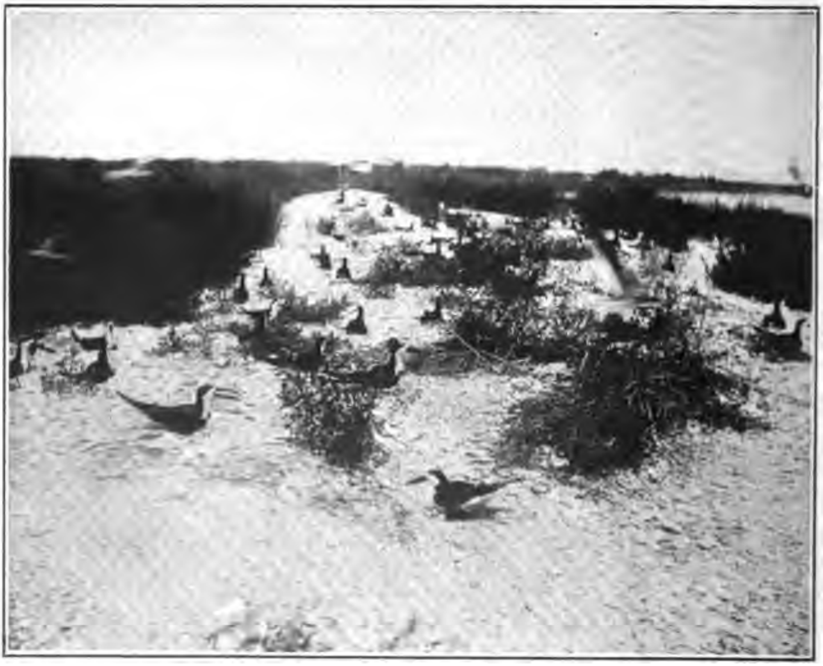


Battledore Island, Louisiana. A. C. Bent.



Battledore, Island ,Louisiana. A. C. Bent.

BLACK SKIMMER.

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fully gliding on their long, slender wings close to the surface in search of their finny prey, the tiny minnows, which have followed the advancing tide into the protecting, grassy shallows. It is a pleasure to sit and watch their graceful evolution in their untiring efforts to secure a meal, as they quarter back and forth over the same ground again and again, cutting the smooth surface of the water with their razor-like bills, scaling, wheeling, and turning like giant swallows, silently engrossed in their occupation for which they are so highly specialized.

Spring.—The black skimmers arrive on their breeding grounds on Cobb's Island and in its vicinity late in April or early in May but they are late breeders. For several weeks they roam about in large flocks or roost on the sand bars in masses so dense that they blacken the ground, every bird facing the wind. When resting or sleeping in such situations they squat closely or sit upon the sand for hours, but if approached every bird rises to its feet and simultaneously all mount suddenly into the air, flying straight toward the intruder with a chorus of peculiar barking yelps; wheeling just in time they circle over his head, perform a series of aerial evolutions, now high in the air and again close to the water, until they finally settle again on the sand. Their mating performances show off their marvelous powers of flight to advantage and are most exciting as two or more males give chase to the coveted female.

> The coy one, shooting aslant to either side, dashes along with marvelous speed, flying hither and thither, upward, downward, in all directions. Her suitors strive to overtake her; they emit their love cries with vehemence; you are gladdened by their softly aud tenderly ennunciated *ha, ha*, or the *hack, hack, cae, cae*, of the last in the chase. Like the female, they all perform the most curious zigzags as they follow in close pursuit, and as each beau at length passes her in succession he extends his wings for an instant, and in a manner struts by her side. (Audubon, 1840.)

Nesting.—In 1907 I spent the last week in June on Cobb's Island and other islands in its vicinity where I found several large colonies of black skimmers just beginning their breeding operations. On Pig Island, a low, flat, sandy island, entirely devoid of vegetation and barely above high-water mark during the spring tides, I found two large colonies. They had chosen for their breeding grounds the higher portions of the sand flats beyond the reach of high tides, where numerous oyster, clam, and scallop shells were scattered about, half buried in the sand, among which the eggs were not conspicuous. Large numbers of little hollows had been scraped out in the sand, but, even at that late date, June 24, laying had only just begun; two nests were seen with one egg each and one with two eggs. Many of the birds were already squatting on the empty hollows or were busy with their courtships. They were very solicitous, flying out to meet us or circling about in flocks, uttering their characteristic notes of protest. A few days later, June 28, we visited another large colony of black skimmers in a similar situation on Wreck Island. They had evidently begun laying at about the same time, for many of the nests contained two or three eggs and one nest held four. The nest hollows measured from 4 to 5 inches in diameter and from 1 to 2 inches in depth; the nests were all entirely devoid of any attempt at lining. Several pairs of gull-billed terns and a few common terns were nesting in the midst of this colony.

Black skimmers formerly bred commonly on low sandy islands on the coast of New Jersey, but the encroachments of civilization have driven them away to more secluded spots. They still breed abundantly at certain points on the coasts of the Carolinas. Messrs. B. S. Bowdish (1910) and P. B. Philipp in 1909 found about 200 nesting on Royal Shoals, North Carolina, with a number of common and least terns, where on June 24, they were just beginning to lay; and at Bull's Bay, South Carolina, they found about a thousand beginning to lay between June 10 and 15. Mr. Arthur T. Wayne (1910) writes as follows regarding their breeding habits in South Carolina:

> Twenty years age these curious birds used to breed regularly on Sullivans Island, and by May 15 full complements of eggs could be procured. At present, however, the breeding season is much later than formerly, and the birds, as a rule, have forsaken the coast islands (including Sullivans, Long, and Capers) and breed, or try to, mainly on the larger keys. As fast as the eggs are laid they are taken by any boatman who happens to discover them. The birds are thus forced to lay again and again in order to raise a brood, and hence the breeding season is a long one, being protracted through August.

In the Breton Island and other reservations off the coast of Louisiana I found a number of interesting skimmer colonies in 1910, where they have flourished under the adequate protection afforded them. On Grand Cochere, the outermost island, a low, flat sand bar, about 300 pairs were breeding a little apart from the large colonies of royal and Cabot's terns, nesting in hollows in the sand, as usual. The largest colony, and the one most typical of the region, was found on Battledore Island, where I spent the whole of one day (June 21), and, as the birds were very tame under the constant protection of the resident warden, I was able to study them at close range from my blind. On this little island, not over 4 acres in extent, I estimated that fully 5,000 pairs of laughing gulls, 1,000 pairs of black skimmers, 50 pairs of Louisiana herons, 30 pairs of Forster's terns, and 25 pairs of common terns were breeding. A large number of skimmers were nesting by themselves on an open beach of finely broken oyster shells which formed a long narrow point at one end of the island. They were also nesting at several places with the laughing

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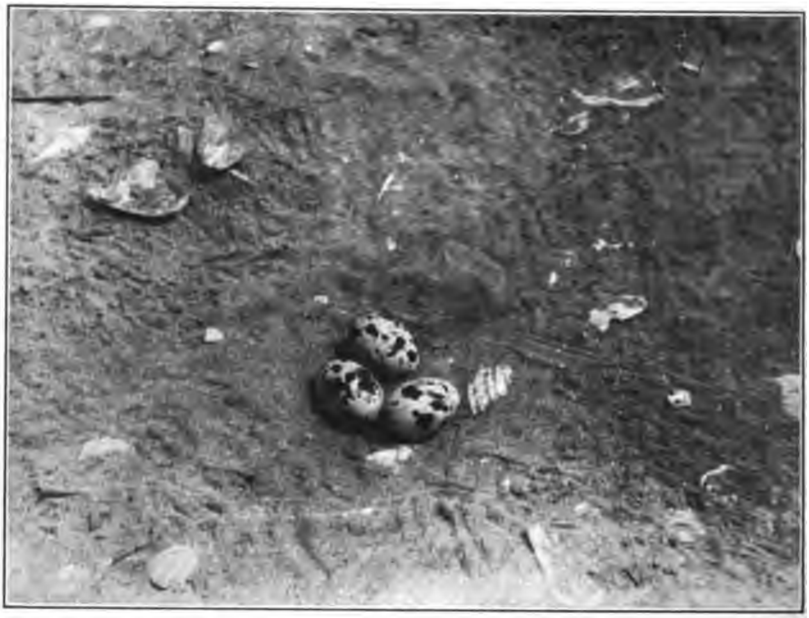
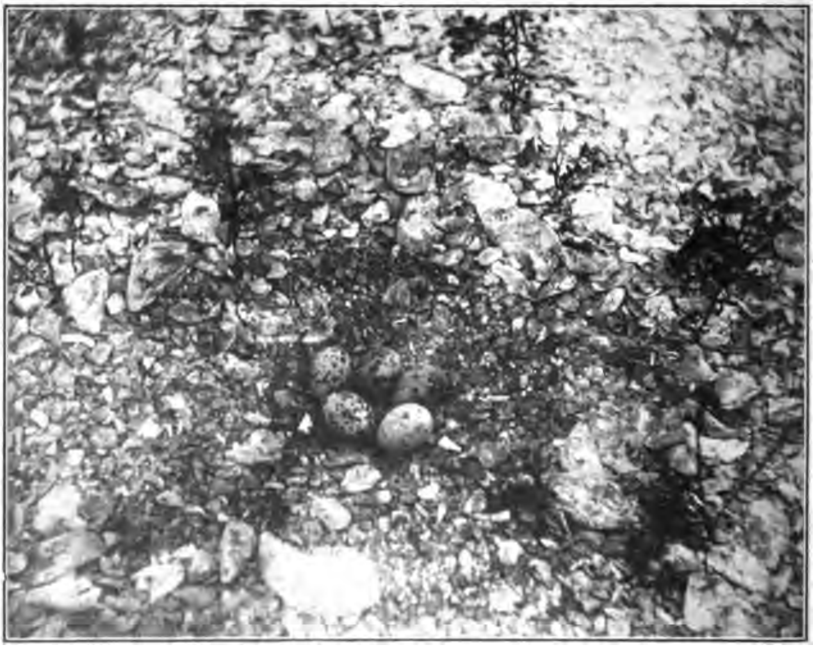


Wreck Island, Virginia. A. C. Bent.



Battledore Island, Louisiana. A. C. Bent.

BLACK SKIMMER.

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gulls on the high ridges of broken oyster shells back of the beaches, which were more or less covered with scattered clumps of beach grass and small mangrove bushes. The gulls' nests were usually concealed among the vegetation, but the skimmers selected the more open spaces. The skimmers' nests were merely hollows scooped out in the loose shells, where the eggs were almost invisible. Nearly all the nests contained full sets of four or five eggs, but no young were seen; I saw only one young skimmer on the whole trip—a newly hatched chick, picked up on Hog Island, on June 22. The impression seems to have prevailed among the earlier writers that the black skimmers do not sit on their eggs in the daytime; it is true that they may, under favorable circumstances, leave their eggs uncovered for considerable periods, but they certainly protect their eggs from the sun's rays on hot days and keep them warm in cold or wet weather. I believe that they incubate most of the time. On Breton Island they certainly returned quickly to their eggs and sat upon them almost constantly within a few feet of my blind. The male usually stands besides his mate while she is incubating.

Life in these closely populated colonies is never dull; birds are constantly coming and going, skimming close over the heads of their sitting companions, causing frequent snappings of beaks or, if they come too near, grunts of protest or even little squabbles. When approaching her nest the bird alights 3 or 4 feet away, looks around carefully, walks slowly to her nest with her head held high, and gradually settles down on the eggs, working them under her plumage with the aid of wings and feet. She is restless and uneasy, craning her neck and looking about at every new comer. She may leave and return to the nest several times before settling down to quiet incubation. On this and other islands in the reservations the black skimmers seemed to be living in perfect harmony with their neighbors, the laughing gulls, and were apparently never robbed by them.

The following extract from some notes, sent to me by Mr. Stanley C. Arthur, is worth quoting, as illustrating the nervous restlessness of this species:

> One pair of skimmers immediately in front of my blind afforded me a great deal of amusement during the entire afternoon. The female was very much scared, it seemed to me, and watched the blind into which I had disappeared, although the rest of the colony paid no attention to the khaki-colored tent that had been erected on their home grounds. This particular skimmer can best be described as being "skerry," and her lord and master was very much exercised over her behavior. She would wing her way over the nesting grounds, then swoop down over her nest of eggs, and when just about to alight would give her long black wings a flap and soon be soaring again into the air. Her mate would watch her approach and departure with sundry twistings of the head, and at times I feared he would twist his neck off, as he endeavored to follow her flight as she would rapidly circle over the eggs. He would run over to the

> eggs with little mincing footsteps and indicate by example how she should come and sit on them. In this performance the male bird did not wholly cover the eggs with his breast feathers, as the incubating birds usually do, but rather squatted over them and followed the aerial revolutions of his mate with a constantly moving head. The wife made several stops as though intending to alight on her eggs, and finally did so, coming lightly to the ground and running up to the eggs and covering them properly with her breast feathers. There would be peace and quiet until some (to me) undiscovered alarm would send the whole colony into the air "baying like a pack of hounds." After several sweeping flights through the air the whole skimmer colony would settle back on the eggs and remain quiet, except for the thin yelps that went on all the time, whether there was anything untoward to excite them or not.

Although the breeding season is often much prolonged by various disasters only one brood is raised in a season. The normal set consists of four or five eggs, though three often constitute a complete set, and sometimes as many as six or seven are laid. In the Breton Island reservation egg laying begins the very last of May or first of June; on the Virginia coast the laying season begins fully three weeks later; the black skimmer is therefore one of the last of the sea birds to lay. The period of incubation seems to be unknown; so far as I have been able to observe only the female incubates.

Eggs.—A series of black skimmer's eggs makes a striking feature in a collection, showing many interesting variations of bold and picturesque color patterns. The ground color is rarely pure white, but usually pale bluish white or creamy white, varying on the one hand to pale greenish blue, almost a heron's egg color, and on the other hand to deep "cream buff" or "pinkish buff." They are usually heavily marked with various shades of brown, from "tawny olive" and "burnt umber" to "seal brown" or "clove brown"; sometimes fairly evenly distributed as small spots, but more often in large irregular blotches or splashes in an endless variety of patterns. Nearly all of the eggs are more or less heavily spotted or blotched, and some are very prettily marked, with various shades of "lilac gray," "lavender gray," or "olive gray." In shape they vary from rounded ovate to elongate ovate, with a prevailing tendency toward the former shape. The measurements of 58 eggs in the United States National Museum average 45 by 33.5 millimeters; the eggs showing the four extremes measure **51** by 32, 45 by **36**, **41.5** by 31, and 43 by **30.5** millimeters.

Young.—Mr. Arthur has sent me the following notes on the behavior of young skimmers:

> While the colony under observation were still incubating their eggs I had an excellent opportunity to note the young in all stages, from those almost ready to fly to the young just out of the shell, and I also had an opportunity of noting the way the young skimmers are fed. This is done in two ways: The downy young are fed by regurgitation, the food being dropped by the parent bird on the ground; but so avid are the little ones for food that they pick at

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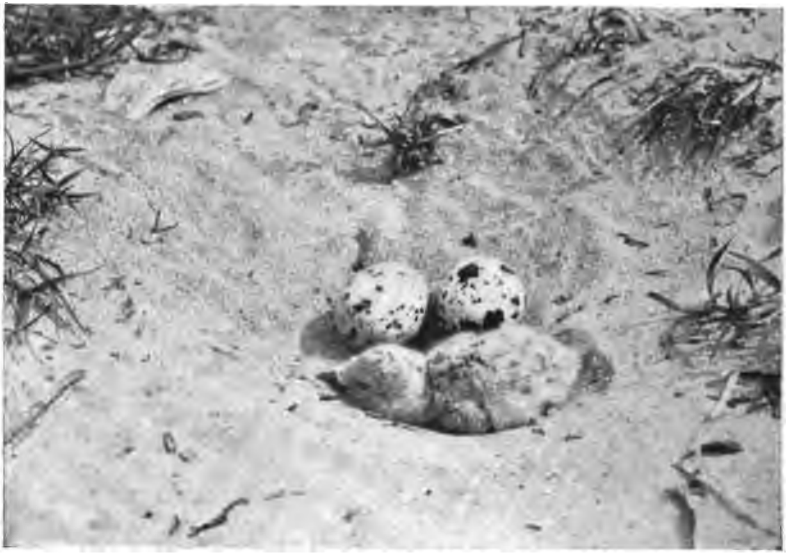
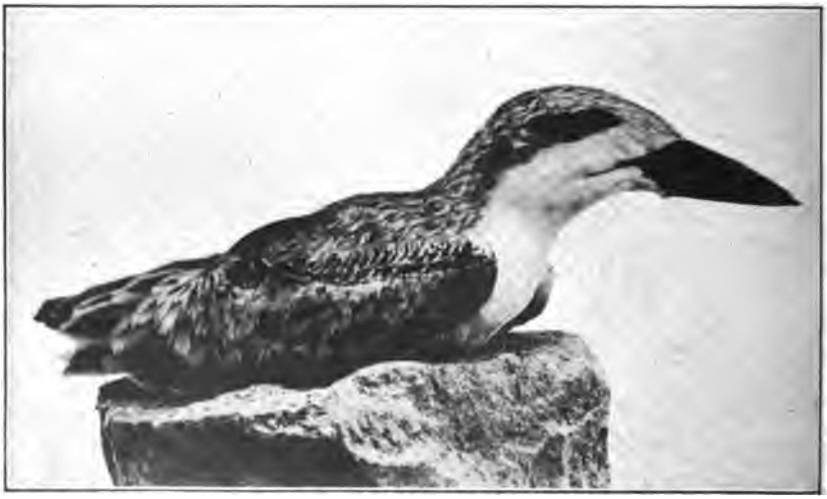


Cobb Island, Virginia. F. M. Chapman.



Cobb Island, Virginia. R. W. Shufeldt.

BLACK SKIMMER.

FOR DESCRIPTION SEE PAGE 337.

the parent bird's bill as the fish is being dropped, and then pick it up as a tiny chicken would pick up moistened bread. When the young birds commence to show their feathers they are fed whole fish by the parent bird. The fish is carried crosswise in the bill of the parent from where they are secured to the nesting grounds and is handed direct to the young bird. If by chance the parent bird drops the fish before its young can take it from the bill, the little one will pick it up from the ground by turning its head and bill sidewise. This is not a difficult accomplishment, as the difference in length between the upper and lower mandibles is very slight at this period.

From their earliest stage the young skimmers have a habit of scratching themselves into a hollow and lying absolutely flat upon the shell-covered beach. While this habit is displayed mostly by the downy young, I have seen it exhibited to a great extent by the feathered young when the young birds are able to run about and danger threatens. Then they will throw themselves flat on the shells of the beach and scratch alternately with their little webbed feet backward. They make about 15 or 20 movements before they snuggle down to rest, and while their legs are in action they make the shells fly most energetically. When the hollow is dug sufficiently to allow them to lie flush with the surrounding beach they remain absolutely motionless, and as their coloration is such as to indicate that nature has provided a protective mimicry, yet they are not difficult to detect; and, as the accompanying photographs show, they stand away from their surroundings most vividly. The chirp of the young is no different from that of the other sea birds, such as the laughing gulls and the terns, and they show the same marked instinct of recognizing their parents' raucous cries from the other alarms.

Plumages.—The young skimmer when first hatched is completely covered with soft, thick down, pale "vinaceous buff" above, lightly mottled with dusky on the back, and only faintly so mottled on the head, the under parts being pure white. As the youngster spends most of its time lying flat on the sand, its protective coloration conceals it admirably. It fades so invisibly into its surroundings that it is hard to realize that it is a living bird. During the downy stage it well knows the value of the hiding pose, and lies prostrate on the sand with head outstretched and eyes closed until touched, when it runs away with surprising agility. The razor-shaped bill is apparent even in the youngest chick, but the specialized bill of the adult is not fully developed until the flight stage is reached. The youngest birds are fed on semidigested food from the parent's throat, but after a few days they learn to run about, and are gradually taught to feed on more solid food, principally small fish. When the young birds have attained their growth and have acquired the juvenal plumage, before they learn to fly, they gather in flocks and learn to feed on what they can pick up along the water's edge. At this time the mandibles are of equal length. The long lower mandible of the adult would be a serious handicap in feeding, and therefore it is not developed until the bird has learned to skim the surface of the water for its food.

The juvenal plumage is handsomely and boldly marked; the upper half of the head is "pale ochraceous salmon" colored and the feathers of the back, scapulars, and wing-coverts are broadly tipped and edged with the same color, each feather being centrally dusky. These edgings, which are fully a quarter of an inch broad on the scapulars, soon fade out to white and wear away, leaving a dingy mottled effect on the upper parts. During the winter some progress is made toward maturity, and at the first prenuptial molt, which is completé, young birds become practically indistinguishable from adults. Adults have two complete molts each year, a prenuptial in February and March and a postnuptial in August and September. The adult winter plumage is similar to the nuptial, but the upper parts are browner, and there is a more or less distinct nuchal collar of whitish feathers.

Food.—The food of the black skimmer consists mainly of small fish, and to some extent shrimps and other small crustaceans. It feeds largely on the wing by skimming close to the smooth water, cutting with its long, rigid lower mandible the surface, from which it scoops into the small mouth the animal food to be found there. The upper mandible, which is movable, can plainly be seen to close down upon any morsel of food which is picked up. That it feeds largely at night everyone knows who has lain at anchor among the shoals of the South Atlantic coast and seen the shadowy forms flitting by in the gloom, but it does not do so exclusively, as has been stated. I have frequently seen it feeding in broad daylight, and think that it is more influenced by the tides than by anything else, for these at certain stages make its food more accessible. It is never seen to dive for its food, and its bill is not adapted for picking it up on the shore.

Mr. Arthur seems to have discovered another method of feeding, about which he writes me:

> According to my observations the birds seek shallow water of not over 3 inches depth and pick up minnows and other small fish by a direct forward movement of the head and bill, in no way differing from a chick picking up a worm on dry land. Skimmers I have had in captivity, where fish was thrown to them on a hard surface, were compelled to turn their heads sideways to pick up the fish; but the skimmers I had under observation were working on a soft mud bottom, and I did not observe a single instance of the head being turned sideways to pick up the food. It was very noticeable at this time that while some of the birds were fishing in the shallow water other skimmers would come skimming over the water in the characteristic manner, but when they came to a stop they, too, began wading around and fishing in the manner I have just described.

Stomachs collected and sent to the United States Bureau of Biological Survey for identification of contents very unfortunately proved to be empty, and I have no positive data from this source as to what constituted the skimmer's food at this time of the year, but on July 5, while on Alexander Island, there occurred an unusual incident, in which a fish, a Forster tern, and a birdologist all figured. Making my way along a stretch of sandy beach I noted a skimmer flying toward the island holding crosswise in its bill a small fish. The reflections of the bright sun rays from the scales of the fish first attracted my attention. I was next attracted by a series of muffled "*yap-yap-yap's*," intermingled with several "*tear-tear-tear-tear-r-r-r-r-r's*" of a very active Forster tern that was pursuing the skimmer and intent upon forcing the big black bird to drop its lawfully acquired prey. The Forster's efforts were without any great success, however, until the two birds performed the aerial fracas just above my head and about 100 feet in the air. At this juncture the tern succeeded in scaring the skimmer by a very quick and vigorous dart aimed at the back of the black bird's head, which caused it to drop the fish, which fell in the mud at the edge of a shallow pond about 75 feet from where I was standing. Recognizing an opportunity to secure positive evidence of the food of the skimmer, I dropped the camera I was carrying and it was "nip and tuck" between the tern and me who would get the fish. I got the fish, but I have never before received such a scolding from a bird. The Forster tern seemed absolutely beside itself with rage, and followed me for over a mile along the beach, where the captain of our patrol boat was waiting for me with a small motor boat. It was not until we had put off from the island and headed in the direction of our large boat that the tern decided that there was no way of bullying me into returning the fish that he felt he had earned by right of combat. I identified the fish, which was about 2½ inches long, as a squeteague, or so-called sea trout, and evidently *Cynoscion nothus*, the so-called "bastard" weak fish; and this information was afterwards concurred in by the United States Bureau of Fisheries.

Behavior.—In flight the black skimmer is one of the most graceful of sea birds and the most highly specialized. Its slender build, its long, powerful wings and its broad forked tail are perfectly adapted to its modes of life. The strongest winds offer but little resistance to the little ball of feathers, supported by two long, slender blades which cut the air like the keenest razor. It has a strong combination of buoyancy and strength; it is swift and skillful on the wing, and always holds itself in perfect control. When flying in a flock, as is customary, its movements are synchronous to a high degree of perfection, the whole flock twisting, turning, wheeling, rising, or falling in perfect unison.

Of its voice not much can be said in the way of praise, for it is harsh and grating and far from pleasing. When flying out to meet the intruder on its breeding grounds it indulges in a chorus of peculiar nasal barking notes or grunting sounds, like the syllables, "Kak, kak, kak," or "Kuk, kuk, kuk," in a low, guttural tone. It also has a variety of soft love notes, sounding like "Kow, kow," or "Keow, keow," suggestive of certain gull notes.

Winter.—Although gregarious at all seasons the black skimmers are especially so in the fall and winter, when they gather in large flocks, flying in close formation, or roosting in dense masses on the sand bars or beaches. It is only when they are feeding that they are scattered out over the shoals. As soon as the young are able to fly in September the fall migration begins, and they retire from the northern portions of their range to spend the winter about the numerous shallow bays, estuaries, and creeks on the coasts of Florida and the Gulf States. They are never seen far out at sea and are seldom driven inland.

DISTRIBUTION.

Breeding range.—On the Atlantic coast from Virginia (Northampton County) to northeastern Florida (Nassau and Dowal Counties). On the Gulf coast from the Florida Keys to Louisiana and southern Texas (Cameron County). Formerly north to New Jersey and still earlier to Massachusetts. Present in summer and probably breeding on the coasts of Venezuela (Margarita) and Yucatan (Progreso).

Breeding grounds protected in the following national reservations: In Alabama, Petit Bois Island; in Louisiana, Breton Island and Tern Islands.

Winter range.—From northern Florida (mouth of St. Johns River) and from the coast of Louisiana southward, all around the Gulf of Mexico, and along the northern and eastern coasts of South America.

Spring migration.—Arrives in South Carolina about the middle of April and in Virginia about the last of April, or first week of May.

Fall migration.—Leaves Virginia about September 10 and South Carolina by November 15 at the latest.

Casual records.—Has wandered as far north and east as the Bay of Fundy (Grand Manan, August, 1879). Accidental inland: New York (Whitesboro, October, 1893); South Carolina (Chester, September 10, 1882); and Tennessee (Obion County). One record for Bermuda (October, 1876).

Egg dates.—Virginia: Thirty-two records, June 2 to July 20; sixteen records, June 18 to 26. South Carolina: Twenty records, May 15 to July 16; ten records, June 23 to July 4. Texas: Twenty records, May 10 to July 4; ten records, June 1 to 15.

REFERENCES TO BIBLIOGRAPHY.

Allen, Francis Henry.

1908—Larus kumlieni and other Northern Gulls in the Neighborhood of Boston. The Auk, vol. 25, p. 296.

Allen, Joel Asaph.

1905—Report on the Birds Collected in Northeastern Siberia by the Jesup North Pacific Expedition. Bulletin of the American Museum of Natural History, vol. 21, p. 219.

Anderson, Rudolph Maria.

1907—The Birds of Iowa. Proceedings of the Davenport Academy of Sciences, vol. 11, p. 125.

1913—Report on the Natural History Collections of the Expedition, in "My Life with the Eskimo," by Vilhjalmur Stefansson.

Anthony, Alfred Webster.

1898—Terns of Socorro Island. The Osprey, vol. 2, p. 123.

1906—Random Notes on Pacific Coast Gulls. The Auk, vol. 23, p. 129.

Arnold, Edward.

1912—A Short Summer Outing in Newfoundland, 1911. The Auk, vol. 29, p. 72.

Astley, Hubert Delaval.

1901—My Birds in Freedom and Captivity.

Audubon, John James.

1840—The Birds of America.

Bailey, Harold Harris.

1906—Ornithological Notes from Western Mexico and the Tres Marias and Isabella Islands. The Auk, vol. 23, p. 369.

1913—The Birds of Virginia.

Bailey, Harry Balch.

1876—Notes on Birds Found Breeding on Cobb's Island, Va., between May 25 and May 29, 1875. Quarterly Bulletin of the Nuttall Ornithological Club, vol. 1, p. 24.

Baird, Spencer Fullerton, Brewer, Thomas Mayo, and Ridgway, Robert.

1884—The Water Birds of North America.

Bendire, Charles Emil.

1888—Eggs of the Ivory Gull (*Gavia alba*). The Auk, vol. 5, p. 202.

Barrows, Walter Bradford.

1912—Michigan Bird Life.

Beyer, George E., Allison, Andrew, and Kopman, Henry H.

1906—List of the Birds of Louisiana. The Auk, vol. 23, p. 1 and p. 275; vol. 24, p. 314.

Bishop, Watson L.

1888—Breeding Dates of Birds in Kings County, Nova Scotia. Ornithologist and Oologist, vol. 13, p. 44.

Blanchan, Neltje.

1898—Birds that Hunt and are Hunted.

Bowdish, Beecher Scoville.

1900—A Day on De Cicheo Island. The Oologist, vol. 17, p. 117.

1902—Birds of Porto Rico. The Auk, vol. 19, p. 356.

1910—Bird Photographing in the Carolinas. The Auk, vol. 27, p. 305.

Bowles, John Hooper.

1909—The Birds of Washington.

Braislin, William Coughlin.

1903—Notes Concerning Certain Birds of Long Island, N. Y. The Auk, vol. 20, p. 50.

Brewster, William.

1878—The Short-tailed Tern (*Hydrochelidon fissipes*) in Massachusetts. Bulletin of the Nuttall Ornithological Club, vol. 3, p. 190.

1879—The Terns of the New England Coast. Bulletin of the Nuttall Ornithological Club, vol. 4, p. 13.

1883—Notes on the Birds Observed During a Summer Cruise in the Gulf of St. Lawrence. Proceedings of the Boston Society of Natural History, vol. 22, p. 364.

1883*a*—On an Apparently New Gull from Eastern North America. Bulletin of the Nuttall Ornithological Club, vol. 8, p. 214.

1902—Birds of the Cape Region of Lower California. Bulletin of the Museum of Comparative Zoology at Harvard College, vol. 41, no. 1.

1912—Notes on the Flight of Gulls. The Auk, vol. 29, p. 85.

Brooks, Winthrop Sprague.

1915—Notes on Birds from East Siberia and Arctic Alaska. Bulletin of the Museum of Comparative Zoology at Harvard College, vol. 59, no. 5.

Bryant, Walter [Pierc] E.

1888—Birds and Eggs from the Farallone Islands. Proceedings of the California Academy of Sciences; second series, vol. 1, p. 25.

Buturlin, Sergius Aleksandrovich.

1906—The Breeding Grounds of the Rosy Gull. The Ibis, 1906, p. 131.

Cahoon, John Cyrus.

1890—The Shore Bird Migration at Monomoy Island, Cape Cod, Mass., Summer of 1888. Ornithologist and Oologist, vol. 15, p. 49.

Chamberlain, Montague.

1891—A Popular Handbook of the Ornithology of the United States and Canada, based on Nuttall's Manual.

Chambers, Willie Lee.

1908—The Present Status of the Least Tern in Southern California. The Condor, vol. 10, p. 237.

Chapman, Frank Michler.

1903—The Bird Life of Cobb's Island. Bird-Lore, vol. 5, p. 109.

1904—The Black Tern at Home. Bird-Lore, vol. 6, p. 1.

1908—Camps and Cruises of an Ornithologist.

Clark, William Eagle.

1898—On the Avifauna of Franz Josef Land. The Ibis, 1898, p. 249.

Cole, Arthur A.

1910—Early Appearance of Gulls on Cobalt Lake, Ontario, Canada. Bird-Lore, vol. 12, p. 146.

Collett, Robert.

1888—On a Breeding colony of Larus eburneus on Spitsbergen. The Ibis, 1888, p. 440.

COLLINS, WILLIAM H.
1880—Notes on the Breeding Habits of some of the Water-Birds of St. Clair Flats, Michigan. Bulletin of the Nuttall Ornithological Club, vol. 5, p. 61.
COOKE, WELLS WOODBRIDGE.
1911—Our Greatest Travelers. The National Geographic Magazine, vol. 22, p. 346.
1915—Distribution and Migration of North American Gulls and their Allies. United States Department of Agriculture Bulletin, No. 292.
COUES, ELLIOTT.
1877—Birds of the North-West.
1903—Key to North American Birds, Fifth Edition.
DAGGETT, FRANK SLATER.
1890—Isle Royale. Ornithologist and Oologist, vol. 15, p. 99.
DALGLEISH, JOHN JAMES.
1886—Discovery of the Nest of *Larus rossii* in Greenland. The Auk, vol. 3, p. 273.
DALL, WILLIAM HEALEY.
1873—Notes on the Avifauna of the Aleutian Islands, from Unalaska, Eastward.
DAVIE, OLIVER.
1889—Nests and Eggs of North American Birds, third edition.
DAWSON, WILLIAM LEON.
1908—The New Reserves on the Washington Coast. The Condor, vol. 10, p. 45.
1908*a*—The Bird Colonies of the Olympiades. The Auk, vol. 25, p. 153.
1909—The Birds of Washington.
DILL, HOMER R., and BRYAN, WILLIAM ALANSON.
1912—Report on Conditions on the Hawaiian Bird Reservation with List of the Birds found on Laysan. United States Department of Agriculture, Biological Survey, Bulletin No. 42.
DRESSER, HENRY EELES.
1871—A History of the Birds of Europe.
DUTCHER, WILLIAM.
1888—Bird notes from Long Island, N. Y. The Auk, vol. 5, p. 169.
1901—Results of Special Protection to Gulls and Terns obtained through the Thayer Fund. The Auk, vol, 18, p. 76.
1903—Report of the A. O. U. Committee on the Protection of North American Birds. The Auk, vol. 20, p. 101.
1905—Report of the National Association of Audubon Societies. Bird-lore, vol. 7, p. 43.
1905*a*—Gulls Destroy Insects and Mice. Bird-lore, vol. 7, p. 290.
DUTCHER, WILLIAM and BAILY, WILLIAM LLOYD.
1903—A Contribution to the Life History of the Herring Gull in the United States. The Auk, vol. 20, p. 417.
DWIGHT, JONATHAN.
1901—The Sequence of Moults and Plumages of the Laridae (Gulls and Terns). The Auk, vol. 18, p. 49.
1906—Status and Plumages of the White-winged Gulls of the Genus Larus. The Auk, vol, 23, p. 26.
1917—The Status of "Larus thayeri, Thayer's Gull." The Auk, vol. 34, p. 413.

EIFRIG, CHARLES WILLIAM GUSTAVE.
1905—Ornithological Results of the Canadian "Neptune" Expedition to Hudson Bay and Northward. The Auk, vol 22, p. 233.

ELLIOTT, HENRY WOOD.
1875—A Report upon the Condition of Affairs in the Territory of Alaska, chap. 10, p. 194, Ornithology of the Prybilov Islands, by Elliott Coues.
1880—Report on the Seal Islands of Alaska.

EVANS, WILLIAM.
1891—On the Periods occupied by Birds in the Incubation of their Eggs. The Ibis, 1891, p. 52.

EVERMANN, BARTON WARREN.
1913—Eighteen Species of Birds New to the Pribilof Islands, Including Four New to North America. The Auk, vol. 30, p. 15.

FEILDEN, HENRY WEMYSS.
1877—List of Birds Observed in Smith Sound and in the Polar Basin during the Arctic Expedition of 1875–76. The Ibis, 1877, p. 401.

FERRY, JOHN FARWELL.
1910—Birds Observed in Saskatchewan during the Summer of 1909. The Auk, vol. 27, p. 185.

FIELD, GEORGE WILTON.
1894—Notes on the Birds of Port Henderson, Jamaica, West Indies. The Auk, vol. 11, p. 117.

FINLEY, WILLIAM LOVELL.
1905—Among the Seabirds off the Oregon Coast. The Condor, vol. 7, pp. 119 aud 161.
1907—Among the Gulls on Klamath Lake. The Condor, vol. 9, p. 12.

FISHER, ALBERT KENRICK.
1893—The Death Valley Expedition. North American Fauna, No. 7.

FISHER, WALTER KENRICK.
1906—Birds of Laysan and the Leeward Islands, Hawaiian Group. Bulletin of the United States Fish Commission, vol. 23, pt. 3, p. 769.

FISHER, WILLIAM HARMANUS.
1897—Cobb's Island, Virginia. The Osprey, vol. 1, p. 107.

FORBES, ALEXANDER.
1913—Concerning the Flight of Gulls. The Auk, vol. 30, p. 359.

FORBES, HENRY OGG.
1898—British Birds, with their Nests and Eggs, Order Gaviae, vol. 6, p. 1.

FRAZAR, MARTIN ABBOTT.
1887—An Ornithologist's Summer in Labrador. Ornithologist and Oologist vol. 12, p. 1.

GÄTKE, HEINRICH.
1895—Heligoland as an Ornithological Observatory.

GIFFORD, EDWARD WINSLOW.
1913—The Birds of the Galapagos Islands. Proceedings of the California Academy of Sciences, Fourth Series, vol. 2, p. 1.

GOODWIN, S. H.
1904—About the Utah Gulls. The Condor, vol. 6, p. 99.

GOSS, NATHANIEL STICKNEY.
1891—History of the Birds of Kansas.

GOSSE, PHILIP HENRY.
1847—The Birds of Jamaica.

Grinnell, Joseph.
1900—Birds of the Kotzebue Sound Region. Pacific Coast Avifauna, No. 1.
1915—A Distributional List of the Birds of California. Pacific Coast Avifauna, No. 11.

Hagerup, Andreas Thomsen.
1891—The Birds of Greenland.

Hatch, Philo Lucis.
1892—Notes on the Birds of Minnesota.

Headley, Frederick Webb.
1912—The Flight of Birds.

Heermann, Adolphus L.
1859—Report upon Birds Collected on the Survey. U. S. Explorations and Surveys for a Railroad to the Pacific, vol. 10, p. 29.

Henninger, Walther Friedrich.
1910—On Some Eggs Supposed to be New to Science. The Wilson Bulletin, vol. 22. Old series, No. 71, p. 119.

Hill, C. Boyce.
1900—Notes on the Nesting of the Pomatorhine Skua. The Ibis, 1900, p. 526.

Hinckley, F. C.
1900—Notes on the Animal and Vegetable Life of the region of Sushitna and Kuskokwim Rivers. U. S. Geological Survey, 1898–1899, pt. 7, p. 76.

Holland, Arthur H.
1890—On Some Birds of the Argentine Republic, with Notes by P. L. Sclater. The Ibis, 1890, p. 424.
1892—Short Notes on the Birds of Estancia Espartilla, Argentine Republic, The Ibis, 1892, p. 193.

Howell, Alfred Brazier.
1911—A Comparative Study at Cobb's Island, Va. The Auk, vol. 28, p. 449.

Isely, Dwight.
1912—A List of the Birds of Sedgwick County, Kansas. The Auk, vol. 29, p. 25.

Job, Herbert Keightley.
1898—The Enchanted Isles. The Osprey, vol. 3, p. 37.
1910—The Franklin's Gull. National Association of Audubon Societies, Educational Leaflet No. 44, Bird-Lore, vol. 12, p. 124.

Jones, Lynds.
1903—The Terns of the Weepecket Islands, Massachusetts. The Wilson Bulletin, No. 44, vol. 10, p. 94.
1906—A Contribution to the Life History of the Common and Roseate Terns. The Wilson Bulletin, vol. 18, p. 35.
1908—June with the Birds of the Washington Coast. The Wilson Bulletin, vol. 20, pp. 19, 57, and 189, and vol. 21, p. 3.
1909—The Birds of Cedar Point and Vicinity. The Wilson Bulletin, No. 67, vol. 21, p. 55.

Jordan, A. H.
1888—A Visit to the Four Brothers, Lake Champlain. Ornithologist and Oologist, vol. 13, p. 138.

Keeler, Charles Augustus.
1892—On the Natural History of the Farallone Islands. Zoe, vol. 3, p. 144.

Kelsey, Frederick Willis.
1902—The Least Tern at San Diego. The Condor, vol. 4, p. 144.

KING, RICHARD.

1836—Narrative of a Journey to the Shores of the Arctic Ocean in 1833, 1834, and 1835, Under the Command of Captain Back, R. N.

KNIGHT, ORA WILLIS.

1908—The Birds of Maine.

KNOX, JOHN COWING.

1899—My First Trip in '99. The Oologist, vol. 16, pp. 118 and 131.

KOBBÉ, WILLIAM HOFFMAN.

1902—The Status of Certain Supposed Species of the Genus Larus. The Auk, vol. 19, p. 19.

KUMLIEN, LUDWIG.

1879—Contributions to the Natural History of Arctic America. Bulletin of the United States National Museum, No. 15.

KUMLIEN, LUDWIG, and HOLLISTER, NED.

1903—The Birds of Wisconsin. Bulletin of the Wisconsin Natural History Society, vol. 3, new ser., p. 5.

LANGILLE, JAMES HIBBERT.

1884—Our Birds and Their Haunts.

LAWRENCE, GEORGE NEWBOLD.

1864—Catalogue of Birds Collected at the Island of Sombrero, W. I., with Observations by A. A. Julien. Annals of the Lyceum of Natural History in New York, vol. 8, p. 93.

McCLINTOCK, LEOPOLD.

1856—His diary, June 21, 1853. The Natural History Review, vol. 3, p. 40.

McCORMICK, ALOYSIUS IGNATIUS STANISLAUS.

1894—Breeding Habits of the Least Tern in Los Angeles County, California. Bulletin of the Cooper Ornithological Club, vol. 1, p. 49.

McGREGOR, RICHARD CRITTENDEN.

1902—A List of Birds Collected in Norton Sound, Alaska. The Condor, vol. 4, p. 135.

McILWRAITH, THOMAS.

1894—The Birds of Ontario.

MACFARLANE, RODERICK ROSS.

1891—Notes on and List of Birds and Eggs Collected in Arctic America, 1861-1866. Proceedings of the United States National Museum, vol. 14, p. 412.

1908—List of Birds and Eggs Observed and Collected in the Northwest Territories of Canada, between 1880 and 1894, in "Through the Mackenzie Basin," by Charles Mair.

MACGILLIVRAY, WILLIAM.

1852—A History of British Birds.

MACKAY, GEORGE HENRY.

1892—Habits of the American Herring Gull. The Auk, vol. 9, p. 221.

1893—Observations on the Breeding Habits of Larus atricilla in Massachusetts. The Auk, vol. 10, p. 333.

1895—The Terns of Muskeget Island, Massachusetts. The Auk, vol. 12, p. 32.

1897—The Terns of Muskeget Island, Massachusetts, pt. 3. The Auk, vol. 14, p. 383.

1898—The Terns of Muskeget Island, Massachusetts, pt. 4. The Auk, vol. 15, p. 168.

MACOUN, JOHN.

1909—Catalogue of Canadian Birds, second edition.

MANNICHE, A. L. V.
1910—The Terrestrial Mammals and Birds of Northeast Greenland. Medelelser om Grønland, vol. 45.
MARS, F. ST.
1912—The Eagle Guard. The Outing Magazine, vol. 59, p. 676, No. 6, March, 1912.
MAYNARD, CHARLES JOHNSON.
1896—The Birds of Eastern North America.
MORRIS, FRANCIS ORPEN.
1903—A History of British Birds, fifth edition.
MURDOCH, JOHN.
1885—Report of the International Polar Expedition to Point Barrow, Alaska, part 4, Natural History, p. 91.
NANSEN, FRIDTJOF.
1899—The Norwegian North Polar Expedition, 1893–1896, Scientific Results, vol. 4.
NELSON, EDWARD WILLIAM.
1883—The Birds of Bering Sea and the Arctic Ocean.
1887—Report upon Natural History Collections made in Alaska.
1899—Birds of the Tres Marias Islands. North American Fauna, No. 14, p. 21.
NOBLE, GEORGE KINGSLEY.
1916—The Resident Birds of Guadeloupe. Bulletin of the Museum of Comparative Zoology at Harvard College, vol. 60, No. 10.
NORTON, ARTHUR HERBERT.
1909—The Food of Several Maine Water-Birds. The Auk, vol. 26, p. 439.
1910—The Little Gull, Larus minutus Pall., in Maine, with remarks on its distribution and its occurrence in America. The Auk, vol. 27, pp. 447–450.
1918—The Ivory Gull (Pagophila alba) at Portland, Me. The Auk, vol. 35, p. 220.
NUTTALL, THOMAS.
1834—A Manual of the Ornithology of the United States and Canada. Water Birds.
OBERHOLSER, HARRY CHURCH.
1918—The Subspecies of Larus hyperboreus Gunnerus. The Auk, vol. 35, p. 467.
OSBURN, PINGREE I.
1909—The Nesting of the Heermann Gull. The Condor, vol. 11, p. 151.
PALMER, WILLIAM.
1890—Notes on the Birds observed during the Cruise of the United States Fish Commission Schooner Grampus in the summer of 1887. Proceedings of the United States National Museum, vol. 13, p. 249.
1899—The Avifauna of the Pribilof Islands. The Fur-Seals and Fur-Seal Islands of the North Pacific Ocean, Part 3, p. 355.
PARRY, WILLIAM EDWARD.
1824—Journal of a second voyage for the discovery of a Northwest Passage.
PEABODY, PUTNAM BURTON.
1896—A Tern Study. The Osprey, vol. 1, p. 1.
PEARSON, THOMAS GILBERT.
1908—Cabot's Tern (Sterna sandvicensis acuflavida) Breeding in North Carolina. The Auk, vol. 25, p. 312.

PREBLE, EDWARD ALEXANDER.

1908—A Biological Investigation of the Athabaska-Mackenzie Region. North American Fauna, No. 27.

PRESTON, J. W.

1886—Breeding of Franklin's Gull in Minnesota. Ornithologist and Oologist, vol. 11, p. 54.

RAY, MILTON SMITH.

1903—A List of Water Birds of Lake Valley, Central Sierra Nevada Mountains, California. The Condor, vol. 5, p. 47.

1904—A Fortnight on the Farallones. The Auk, vol. 21, p. 425.

RAY, PATRICK HENRY.

1885—Report of the International Polar Expedition to Point Barrow, Alaska. Part 4, Natural History, p. 91.

REED, CHESTER ALBERT.

1904—North American Birds' Eggs.

RICHARDSON, JOHN.

1825—Appendix to Capt. Parry's Journal of Second Voyage for the Discovery of a Northwest Passage.

1851—Arctic Searching Expedition.

RIDGWAY, ROBERT.

1880—Description of the Eggs of the Caspian Tern (Sterna caspia). Bulletin of the Nuttall Ornithological Club, vol. 5, p. 221.

1886—On the Glaucous Gull of Bering Sea and Contiguous Waters. The Auk, vol. 3, p. 330.

1887—A Manual of North American Birds.

RIVES, WILLIAM CABELL.

1890—A Catalogue of the Birds of the Virginias. Proceedings of the Newport Natural History Society, no. 7.

ROBERTS, THOMAS SADLER.

1877—Notes on the Breeding of the Black Tern (Hydrochelidon lariformis) in Minnesota. Bulletin of the Nuttall Ornithological Club, vol. 2, p. 34.

1900—An Account of the Nesting Habits of Franklin's Rosy Gull (Larus franklinii), as Observed at Heron Lake in Southern Minnesota. The Auk, vol. 17, p. 272.

ROCKWELL, ROBERT BLANCHARD.

1911—Notes on the Nesting of the Forster and Black Terns in Colorado. The Condor, vol. 13, p. 57.

ROSS, JAMES CLARK.

1835—Natural History, in Appendix to the narrative of a second voyage in search of a Northwest Passage, by Sir John Ross.

RUSSELL, FRANK.

1898—Explorations in the Far North.

SAUNDERS, HOWARD.

1889—An Illustrated Manual of British Birds.

SCOTT, WILLIAM EARL DODGE.

1887—The Present Conditions of Some of the Bird Rookeries of the Gulf Coast of Florida. The Auk, vol. 4, pp. 135, 213, and 273.

1888—A Summary of Observations on the Birds of the Gulf Coast of Florida. The Auk, vol. 5, p. 373.

1891—Observations on the Birds of Jamaica, West Indies. The Auk, vol. 8, p. 249 and p. 353.

Selby, Prideaux John.

1833—Illustrations of British Ornithology.

Selous, Edmund.

1905—The Bird Watcher in the Shetlands.

Sennett, George Burritt.

1878—Notes on the Ornithology of the Lower Rio Grande of Texas. Bulletin of the United States Geological and Geographical Survey, vol. 4, p. 1.

Seton, Ernest Thompson.

1908—Bird Records from Great Slave Lake Region. The Auk, vol. 25, p. 68.

Stejneger, Leonhard.

1885—Results of Ornithological Explorations in the Commander Islands and in Kamtschatka. Bulletin of the United States National Museum, No. 29.

Stone, Witmer.

1909—The Birds of New Jersey, Their Nests and Eggs. Annual Report of the New Jersey State Museum.

Strong, Reuben Myron.

1914—On the Habits and Behaviour of the Herring Gull, Larus argentatus Pont. The Auk, vol. 31, pp. 22 and 178.

Suckley, George, and Cooper, James Graham.

1860—The Natural History of Washington Territory and Oregon.

Swainson, William, and Richardson, John.

1831—Fauna Boreali-Americana, vol. 2, Birds.

Thayer, John Eliot.

1911—A Nesting Colony of Heermann Gulls and Brewster Boobies. The Condor, vol. 13, p. 104.

1911*a*—Eggs of the Elegant Tern (Sterna elegans). The Oologist, vol. 28, p. 171.

Thayer, John Eliot, and Bangs, Outram.

1914—Notes on the Birds and Mammals of the Arctic Coast of East Siberia—Birds. Proceedings of the New England Zoological Club, vol. 5, p. 1.

Thompson, Ernest Evan.

1890—The Birds of Manitoba. Proceedings of the United States National Museum, vol. 13, p. 457.

Thompson, Joseph.

1903—The Tortugas Tern Colony. Bird-Lore, vol. 5, p. 77.

Townsend, Charles Wendell.

1905—The Birds of Essex County, Massachusetts. Memoirs of the Nuttall Ornithological Club, No. 3.

Townsend, Charles Wendell, and Allen, Glover Morrill.

1907—Birds of Labrador. Proceedings of the Boston Society of Natural History, vol. 33, p. 277.

Turner, Lucien McShan.

1886—Contributions to the Natural History of Alaska.

Tuttle, Albert W.

1911—Pomarine Jaeger Capturing a Phalarope. The Auk, vol. 28, p. 482.

Ward, Henry Levi.

1906—Notes on the Herring Gull and the Caspian Tern. Bulletin of the Wisconsin Natural History Society, vol. 4, p. 113.

1906*a*—Why Do Herring Gulls Kill Their Young? Science, new ser., vol. 24, p. 593.

WARREN, BENJAMIN HARRY.
1890—Report on the Birds of Pennsylvania.

WATSON, JOHN BROADUS.
1908—The Behaviour of Noddy and Sooty Terns. Papers from the Tortugas Laboratory of the Carnegie Institution of Washington, vol. 2, p. 187.

WAYNE, ARTHUR TREZEVANT.
1910—Birds of South Carolina. Contributions from the Charleston Museum, 1.

WELLS, JOHN GRANT.
1902—Birds of the Island of Carriacou. The Auk, vol. 19, p. 239.

WETMORE, ALEXANDER.
1916—Birds of Porto Rico. U. S. Department of Agriculture Bulletin, No. 326.

WILLETT, GEORGE.
1912—Report of G. Willett, Agent and Warden Stationed on St. Lazaria Bird Reservation, Alaska. Bird-Lore, vol. 14, p. 419.

WILSON, ALEXANDER.
1832—American Ornithology. Jardine edition.

YARRELL, WILLIAM.
1871—History of British Birds, Fourth Edition, 1871–1885, Revised and Enlarged by Alfred Newton and Howard Saunders.

EXPLANATION OF PLATES.

HALFTONE PLATES.

PLATE 1.

Group of laughing gulls on beach, Battledore Island, Louisiana, June, 1905, a photograph presented by Mr. Herbert K. Job. (Frontispiece.)

PLATE 2.

Left: Nest and eggs of skua, Kaldafarnes, Iceland, a photograph presented by Mr. J. Wilkinson.

Right: Pomarine jaeger, Chatham, Massachusetts, August 31, 1904, a photograph presented by Mr. Herbert K. Job.

PLATE 3.

Upper: Nest and egg of parasitic jaeger, Kolyma Delta, Siberia, June 27, 1917, from a negative taken by Mr. Johan Koren for the author.

Lower: Nest and eggs of parasitic jaeger, Point Barrow, Alaska, June 25, 1917, from a negative taken by Mr. T. L. Richardson for the author.

PLATE 4.

Upper: Nest and eggs of long-tailed jaeger, St. Michael, Alaska, June 19, 1915, from a negative taken by Mr. F. S. Hersey for the author.

Lower: A nearer view of the same nest, referred to on page 22.

PLATE 5.

Upper: Nest and eggs of long-tailed jaeger, Kolyma Delta, Siberia, June 22, 1917, from a negative taken by Mr. Johan Koren for the author.

Lower: Long-tailed jaeger on its nest, northeast Greenland, published by courtesy of Mr. A. L. V. Manniche, Meddelelser om Grønland.

PLATE 6.

Upper: Nesting site of ivory gull, northeast Greenland, July 18, 1908.

Lower: Nest in above locality. Both published by courtesy of Mr. A. L. V. Manniche, Meddelelser om Grønland.

PLATE 7.

Left: Kittiwake on its nest, Bird Rock, Quebec, June 25, 1904, a photograph presented by Mr. Herbert K. Job.

Right: Kittiwakes on their nests, Bird Rock, Quebec, June 24, 1904, referred to on page 38.

PLATE 8.

Upper: Nests and eggs of kittiwakes, Bird Rock, Quebec, June 25, 1904, referred to on page 38.

Lower: Young kittiwakes, just prior to the flight stage, Bird Rock, Quebec, July 24, 1915, referred to on page 39.

PLATE 9.

Upper: Pacific kittiwakes on their nests, Walrus Island, Alaska, July 7, 1911.

Lower: Nest and eggs of same in the above locality. Both referred to on page 46.

PLATE 10.

Nesting colony of red-legged kittiwakes, Saint George Island, Alaska, a photograph presented by Dr. Charles H. Townsend.

PLATE 11.

Upper: Nest and eggs of glaucous gull, Borup Glenn, Greenland.

Lower: Nearer view of another nest, Sutherland Island, Greenland. Both photographs presented by Mr. Donald B. MacMillan and published by courtesy of the American Museum of Natural History.

PLATE 12.

Upper: Nest and young of glaucous gull, Sulwuddy, Greenland.

Lower: Young glaucous gulls, Cape Kendrick, Greenland. Both photographs presented by Mr. Donald B. MacMillan and published by courtesy of the American Museum of Natural History.

PLATE 13.

Upper: Nesting colony of glaucous-winged gulls, Walrus Island, Alaska, July 7, 1911, referred to on page 68.

Lower: Nest and eggs of same, Bogoslof Island, Alaska, July 4, 1911, referred to on page 67.

PLATE 14.

Upper: Nesting resort of glaucous-winged gulls, Flattery Rocks, Reservation, Washington.

Lower: Nest and eggs of same, Carroll Islet, Washington. Both photographs presented by Mr. W. L. Dawson.

PLATE 15.

Upper: Distant view of nest of great black-backed gull, south coast of Labrador, May 25, 1909.

Lower: Nearer view of same nest, referred to on page 77.

PLATE 16.

Upper: Great black-backed gull, trumpeting, Lake George, Nova Scotia, July 28, 1912, referred to on page 84.

Lower: Adult and young bird, one year old, same locality and date. Both photographs presented by Mr. H. H. Cleaves.

PLATE 17.

Upper: Western gulls in breeding colony, Farallon Islands, August 10, 1919, a photograph presented by Mr. Oluf J. Heinemann.

Lower: Breeding colony of same, Humboldt County, California, a photograph presented by Mr. W. L. Dawson.

PLATE 18.

Upper: Nest and young of western gull, Farallon Islands, July 3, 1914, a photograph presented by Mr. Oluf J. Heinemann.

Lower: Nest and eggs of same, Los Coronados Islands, Lower California, a photograph presented by Mr. Donald R. Dickey.

PLATE 19.

Upper: Nesting site of herring gulls, Heron Island, Maine, July 11, 1915.

Lower: Herring gulls in breeding colony, Little Spoon Island, Maine, July 12, 1915.

PLATE 20.

Upper: Nest and eggs of herring gull, Seal Island, Nova Scotia, July 4, 1904.

Lower: Another nest of same, Heron Island, Maine, July 11, 1915.

PLATE 21.

Upper: Nest and young of herring gull, Heron Island, Maine, July 11, 1915.

Lower: Young herring gull, half fledged, Matinicus Rock, Maine, July, 1906; a photograph presented by Mr. Herbert K. Job.

PLATE 22.

Upper: Nest and eggs of Vega gull, Kolyma Delta, Siberia, July, 1916.

Lower: Another nest in same locality, July 6, 1917. Both from negatives taken by Mr. Johan Koren for the author.

PLATE 23.

Upper: Nesting colony of California and ring-billed gulls, Big Stick Lake, Saskatchewan, June 14, 1906, referred to on page 125.

Lower: Nests of California gulls, in shallow water, in same colony.

PLATE 24.

Upper: Nest and eggs of California gull, Big Stick Lake, Saskatchewan, June 14, 1906, referred to on page 126.

Lower: Nest and young of same in same colony.

PLATE 25.

Upper: Nesting colony of ring-billed and California gulls, Big Stick Lake, Saskatchewan, June 14, 1906, referred to on page 133.

Lower: Nests and eggs of ring-billed gull in same colony.

Plate 26.

Upper: Nest and eggs of ring-billed gull, Prince William Sound, Alaska, June, 1912, a photograph presented by Mr. George G. Cantwell, referred to on page 135.

Lower: Nest and young of same, Big Stick Lake, Saskatchewan, June 14, 1906.

Plate 27.

Upper: Nesting site of short-billed gull, Lake Athabaska, Saskatchewan, June 27, 1914.

Lower: Nest and egg in above locality. Both photographs presented by Mr. Francis Harper and published by courtesy of the Geological Survey of Canada.

Plate 28.

Upper: Nesting site of short-billed gull, St. Michael, Alaska, June 19, 1915, referred to on page 141.

Lower: Nest, egg, and young of same in above locality. Both photographs taken by Mr. F. S. Hersey for the author.

Plate 29.

Upper: Nesting colony of Heermann's gulls, Ildefonso Island, Lower California, March 28, 1909, referred to on page 148.

Lower: Another view in same colony April 8, 1909. Both from photographs taken by Mr. W. W. Brown for Col. John E. Thayer; published by courtesy of The Condor.

Plate 30.

Upper: Nest and eggs of laughing gull, Muskeget Island, Massachusetts, June 22, 1902, referred to on page 155.

Lower: Nest and young of same in above locality, July 4, 1904.

Plate 31.

Upper: Young laughing gull, hiding in grass, Muskeget Island, Massachusetts. August 3, 1916, referred to on page 158.

Lower: Young laughing gull, just prior to flight stage, same locality, August 4, 1916; a photograph presented by Dr. Alfred O. Gross.

Plate 32.

Upper: Pair of laughing gulls at the nest, Louisiana, June, 1908; a photograph presented by Mr. Herbert K. Job.

Lower: Laughing gull on its nest, Louisiana; a photograph presented by Mr. Alfred M. Bailey.

Plate 33.

Upper: Nesting colony of Franklin's gulls, Lake of the Narrows, Saskatchewan, June 9, 1905, a photograph presented by Mr. Herbert K. Job.

Lower: Gull alighting on nest in above colony, referred to on page 164.

PLATE 34.

Upper: Nest and eggs of Franklin's gull, Lake of the Narrrows, Saskatchewan, June 9, 1905.

Lower: Nest and young of same, in above locality, referred to on page 165.

PLATE 35.

Upper: Pair of Franklin's gulls on their nest, North Dakota.

Lower: Group of Franklin's gulls in nesting colony, Lake of the Narrows, Saskatchewan, June 9, 1905. Both photographs presented by Mr. Herbert K. Job.

PLATE 36.

Upper: Nesting site of Sabine's gull, Saint Michael, Alaska, June 5, 1915, referred to on page 192.

Lower: Nest and eggs of same in above locality. Both from negatives taken by Mr. F. S. Hersey for the author.

PLATE 37.

Upper: Nest and eggs of Sabine's gull, Saint Michael, Alaska, June 5, 1915, referred to on page 192.

Lower: Young Sabine's gull, Saint Michael, Alaska, June 19, 1915. Both from negatives taken by Mr. F. S. Hersey for the author.

PLATE 38.

Upper: Nesting site of gull-billed tern, Cobb Island, Virginia, June 26, 1907, referred to on page 198.

Lower: Nest and eggs of same in above locality.

PLATE 39.

Upper: Gull-billed tern in its nest, Cobb Island, Virginia, July, 1902, from a photograph taken by Dr. Frank M. Chapman, published by his permission and by courtesy of D. Appleton & Co., publishers of "Camps and Cruises."

Lower: Young gull-billed tern, Cobb Island, Virginia, a photograph presented by Mr. Herbert K. Job.

PLATE 40.

Upper: Nests and eggs of Caspian tern, Grand Cochere, Louisiana, June 19, 1910, referred to on page 204.

Lower: One of above nests.

PLATE 41.

Caspian tern on its nest, Alexander Island, Louisiana, July 3, 1918, a photograph presented by Mr. Stanley C. Arthur.

PLATE 42.

Upper: Nesting colony of Caspian terns, Lower Klamath Lake, Oregon, referred to on page 205.

Lower: Old and young birds in above colony. Both photographs presented by Mr. William L. Finley.

PLATE 43.

Upper: Flock of royal terns, Grand Cochere, Louisiana, June 19, 1910.
Lower: Eggs in above colony, referred to on page 213.

PLATE 44.

Upper: Nesting colony of royal terns, Grand Cochere, Louisiana, June 19, 1910, referred to on page 214.
Lower: Pair of royal terns and young, Louisiana, a photograph presented by Mr. Alfred M. Bailey.

PLATE 45.

Upper: Flock of young royal terns, Louisiana, July 5, 1918.
Lower: Young royal terns, Louisiana, June 15, 1918. Both photographs presented by Mr. Stanley C. Arthur.

PLATE 46.

Upper: Nesting colony of Cabot's terns, Grand Cochere, Louisiana, June 19, 1910, referred to on page 222.
Lower: Eggs of Cabot's tern in same locality.

PLATE 47.

Nesting colony of Cabot's terns, with a few royal terns, Louisiana; a photograph presented by Mr. Alfred M. Bailey.

PLATE 48.

Upper: Nesting colony of Cabot's terns, with one royal tern, Southwest Key, Louisiana, June, 1908; a photograph presented by Mr. Herbert K. Job.
Lower: Young Cabot's tern, Louisiana, June 16, 1918, a photograph presented by Mr. Stanley C. Arthur.

PLATE 49.

Upper: Nests of Forster's terns, Wreck Island, Virginia, June 28, 1907, referred to on page 230.
Lower: One of above nests.

PLATE 50.

Upper: Nests of Forster's terns, Barr Lake, Colorado, May 24, 1907.
Lower: Young Forster's terns in above colony. Both photographs presented by Mr. Robert B. Rockwell. Referred to on page 231.

PLATE 51.

Upper: Nest and eggs of Forster's tern, Barr Lake, Colorado, a photograph presented by the Colorado Museum of Natural History.
Lower: Forster's tern on its nest, Malheur Lake, Oregon, a photograph presented by Mr. W. L. Finley.

PLATE 52.

Upper: Nest and eggs of common tern, Penobscot Bay, Maine, June 12, 1900, referred to on page 240.
Lower: Another nest of same, Muskeget Island, Massachusetts, June 22, 1902, referred to on page 239.

PLATE 53.

Upper: Young common terns, recently hatched, Chatham, Massachusetts, June 29, 1916.

Lower: Older young of same, Muskeget Island, Massachusetts, July 4, 1903.

PLATE 54.

Upper: Common tern on its nest, Chatham, Massachusetts, June 13, 1919.

Lower: Nesting colony of same in above locality, same date.

PLATE 55.

Upper: Nest and eggs of arctic tern, Chatham, Massachusetts, June 29, 1916.

Lower: Another nest of same, Yukon Delta, Alaska, June 19, 1914, from negative taken by Mr. F. S. Hersey for the author.

PLATE 56.

Upper: Arctic tern at its nest, Matinicus Rock, Maine, July, 1906.

Lower: Another nest of same in above locality. Both photographs presented by Mr. Herbert K. Job.

PLATE 57.

Upper: Young arctic terns, recently hatched, Chatham, Massachusetts, June 29, 1916.

Lower: Two older young of same Matinicus Rock, Maine, July, 1906, a photograph presented by Mr. Herbert K. Job.

PLATE 58.

Upper: Nests and eggs of roseate tern, Muskeget Island, Massachusetts, June 22, 1902.

Lower: Another nest of same in above locality, referred to on page 257.

PLATE 59.

Upper: Nesting colony of roseate terns, Muskeget Island, Massachusetts, June 10, 1919, referred to on page 257.

Lower: Roseate tern on its nest, above locality and date.

PLATE 60.

Upper: Roseate tern and young, Weepecket Island, Massachusetts, July 1, 1919.

Lower: Roseate tern, same locality and date.

PLATE 61.

Upper: Young roseate tern, about 5 days old, Dry Tortugas, Florida.

Lower: Young roseate tern, about 3 weeks old, same locality. Both from photographs taken by Dr. Paul Bartsch.

PLATE 62.

Upper: Nest and eggs of Aleutian tern, Saint Michael, Alaska, June 23, 1915, referred to on page 266.

Lower: Nearer view of same nest. Both from negatives taken by Mr. F. S. Hersey for the author.

PLATE 63.

Upper: Nesting site of least terns, Dartmouth, Massachusetts, June 14, 1919.
Lower: Nest and eggs of same, in above locality, June 16, 1916.

PLATE 64.

Upper: Nest and eggs of least tern, Newport Beach, Orange County, California, a photograph presented by Mr. Wright M. Pierce.
Lower: Least terns and young, Louisiana, a photograph presented by Mr. Alfred M. Bailey.

PLATE 65.

Upper: Young least tern, half grown.
Lower: Young least tern, recently hatched. Both photographs presented by Mr. Edward H. Forbush.

PLATE 66.

Upper: Nesting colony of sooty terns, Bird Key, Dry Tortugas, Florida.
Lower: Bird on its nest in above locality. Both photographs presented by Mr. Herbert K. Job.

PLATE 67.

Upper: Nest and two eggs of sooty tern, Bird Key, Dry Tortugas, Florida.
Lower: Ordinary nest of same in above locality. Both photographs presented by Mr. Herbert K. Job.

PLATE 68.

Upper: Young sooty tern, 8 days old, Dry Tortugas, Florida.
Lower: An older bird, 25 days old. Both from photographs taken by Prof. John B. Watson, published by his permission and by courtesy of Bird-Lore.

PLATE 69.

Upper: Nesting site of black terns, Steele County, North Dakota, June 9, 1901, referred to on page 291.
Lower: Nest and eggs of same in above locality.

PLATE 70.

Upper: Nesting site of black tern, Barr Lake, Colorado.
Lower: Nest and eggs of same in above locality. Both photographs presented by Mr. Robert B. Rockwell.

PLATE 71.

Upper: Black tern at its nest, Minneapolis, Minnesota, June, 1918.
Lower: Another bird and nest. Both photographs taken by Mr. Jenness Richardson and presented by the University of Minnesota.

PLATE 72.

Nesting colony of noddies, Bird Key, Dry Tortugas, Florida, a photograph presented by Mr. Herbert K. Job.

PLATE 73.

Upper: Nest and egg of noddy, Bird Key, Dry Tortugas, Florida.

Lower: Pair of noddies at their nest in same locality. Both photographs presented by Mr. Herbert K. Job.

PLATE 74.

Upper: Young noddy in its nest, Dry Tortugas, Florida.

Lower: An older bird in same locality. Both from photographs taken by Dr. Joseph Thompson and published by courtesy of Bird-Lore.

PLATE 75.

Upper: Black skimmers flying over their nesting colony, Battledore Island, Louisiana, June 21, 1910, referred to on page 312.

Lower: View in above colony.

PLATE 76.

Upper: Nest and eggs of black skimmer on sandy beach, Wreck Island, Virginia, June 28, 1907, referred to on page 312.

Lower: Nest and eggs of same on shell beach, Battledore Island, Louisiana, June 21, 1910, referred to on page 312.

PLATE 77.

Upper: Young black skimmer, recently hatched, Cobb Island, Virginia, from a photograph taken by Dr. Frank M. Chapman, published with his permission and by courtesy of D. Appleton & Co., publishers of "Camps and Cruises."

Lower: Young black skimmer in juvenal plumage, September 19, 1895, a photograph, slightly retouched on top of head and back, presented by Dr. R. W. Shufeldt.

COLORED PLATES.

The eggs illustrated in the colored plates were selected from the collection of the United States National Museum, except where otherwise indicated. After the Museum catalogue number of each specimen is given the locality, the date, and the name of the collector as far as known.

PLATE 78.

1. Pomarine jaeger, 18458, Greenland, Governor Fencker.
2. Pomarine jaeger, 18459, Greenland, Governor Fencker.
3. Skua, 24541, Shetland Islands, June 28, 1884, A. Hopeland.
4. Parasitic jaeger, 24542, Monsay coast of Shetland Islands, June 2, 1881, R. Turnbull.
5. Parasitic jaeger, 22155, Kodiak Island, Alaska, June 19, 1884, W. J. Fisher.

PLATE 79.

1. Long-tailed jaeger, 21434, Saint Michael, Alaska, June 16, 1880, E. W. Nelson.
2. Long-tailed jaeger, 11688, Arctic coast, east of Anderson River, R. McFarlane.
3. Ivory gull, 23598, Storðen, Spitzbergen, August 8, 1887, M. Foslic.
4. Glaucous-winged gull, 19061, Kodiak Island, Alaska, July, 1883, W. J. Fisher.
5. Glaucous-winged gull, 19061, Kodiak Island, Alaska, July, 1883, W. J. Fisher.

PLATE 80.

1. Kittiwake, 21512, Greenland, Governor Fencker.
2. Kittiwake, 23257, Bird Rock, Quebec, July 9, 1887, W. Palmer.
3. Pacific Kittiwake, 16739, Saint George Island, Alaska, June 24, 1873, H. W. Elliott.
4. Pacific Kittiwake, 16739, Saint George Island, Alaska, June 24, 1873, H. W. Elliott.
5. Red-legged Kittiwake, 16735, Saint George Island, Alaska, June 25, 1873, H. W. Elliott.
6. Red-legged Kittiwake, 16737, Saint George Island, Alaska, 1873, H. W. Elliott.

PLATE 81.

1. Glaucous gull, 18713, Afognak Island, Alaska, July 12, 1882, W. J. Fisher.
2. Glaucous gull, 21451, Yukon Delta, Alaska, June 4, 1879, E. W. Nelson.
3. Iceland gull, 18446, Christianshaab, Greenland, Governor Fencker.
4. Iceland gull, 18447, Christianshaab, Greenland, 1880, Governor Fencker.

PLATE 82.

1. Great black-backed gull, 18450, Christianshaab, Greenland, Governor Fencker.
2. Great black-backed gull, 24426, Southeast Labrador, June 6, 1884, M. A. Frazar.
3. Western gull, 26442, Tomales Point, California, May 24, 1885, A. M. Ingersoll.
4. Western gull, 26443, Tomales Point, California, May 24, 1885, A. M. Ingersoll.

PLATE 83.

1. Herring gull, 27573, Islin, Midkiff Lake, Hamilton County, New York, May 13, 1894, C. Haskell.
2. Herring gull, 27577, Islin, Midkiff Lake, Hamilton County, New York, May 13, 1894, C. Haskell.
3. Vega gull, A. C. Bent collection, Kolyma River, Siberia, July 10, 1916, J. Koren.
4. Vega gull, A. C. Bent collection, Kolyma River, Siberia, July 6, 1917, J. Koren.

PLATE 84.

1. Ring-billed gull, 3598, Fort George, Hudson Bay, C. Drexler.
2. Ring-billed gull, 6074, Lake Winnipeg, Manitoba, Donald Gunn.
3. California gull, 13721, Pyramid Lake, Nevada, May 16, 1868, R. Ridgway.
4. California gull, 13700, Pyramid Lake, Nevada, May 16, 1868, R. Ridgway.
5. California gull, 24676, Pyramid Lake, Nevada, June 4, 1891.

PLATE 85.

1. Short-billed gull, 19064, Kodiak Island, Alaska, 1883, W. J. Fisher.
2. Short-billed gull, 29218, Prince William Sound, Alaska, June 26, 1899, A. K. Fisher.

3. Mew gull, 24544, Murray Islands, Fleet Bay, Scotland, May 6, 1885, R. Sevell.
4. Heermann's gull, 32004, Ildefonso Island, Lower California, April 8, 1909, W. W. Brown, jr.
5. Heermann's gull, 31965, Ildefonso Island, Lower California, April 8, 1909, W. W. Brown, jr.

Plate 86.

1. Laughing gull, 23332, Cobb Island, Virginia, July 16, 1884, H. M. Smith.
2. Laughing gull, 23331, Cobb Island, Virginia, July 16, 1884, H. M. Smith.
3. Laughing gull, 18139, Rapeza Marsh, Virginia, R. Ridgway.
4. Franklin's gull, 14212, Red River Settlements, 1865, D. Gunn.
5. Franklin's gull, 12735, Lake Manitoba, Manitoba, D. Gunn.
6. Franklin's gull, 24431, Jackson County, Minnesota, May 18, 1890, O. L. Bullis.

Plate 87.

1. Bonaparte's gull, 15745, Fort Anderson, Mackenzie, 1866, R. McFarlane.
2. Bonaparte's gull, 15744, Fort Anderson, Mackenzie, 1866, R. McFarlane.
3. Bonaparte's gull, 11484, Fort Anderson, Mackenzie, 1866, R. McFarlane.
4. Little gull, 15572, North Ladoga, Russia, June 1, 1869, H. E. Dresser.
5. Ross's gull, 31096, Kolyma Delta, Siberia, June 13, 1905, S. Buturlin.
6. Sabine's gull, 21401, Saint Michael, Alaska, 1877, E. W. Nelson.
7. Sabine's gull, 11529, Franklin Bay, Mackenzie, 1865, R. McFarlane.
8. Sabine's gull, 21408, Saint Michael, Alaska, 1877, E. W. Nelson.

Plate 88.

1. Caspian tern, 22556, Corpus Christi, Texas, June 15, 1888, B. F. Goss.
2. Caspian tern, 22560, Corpus Christi, Texas, May 6, 1888, B. F. Goss.
3. Royal tern, 26303, San Antonio Bay, Texas, May 12, 1892, H. P. Attwater.
4. Royal tern, 26303, San Antonio Bay, Texas, May 12, 1892, H. P. Attwater.
5. Royal tern, 21589, Clearwater, Florida, S. T. Walker.

Plate 89.

1. Elegant tern, J. E. Thayer collection, Cerralvo Island, Lower California, April 10, 1910, W. W. Brown, jr.
2. Elegant tern, J. E. Thayer collection, Cerralvo Island, Lower California, April 10, 1910, W. W. Brown, jr.
3. Elegant tern, J. E. Thayer collection, Cerralvo Island, Lower California, April 10, 1910, W. W. Brown, jr.
4. Cabot's tern, 26317, San Antonio Bay, Texas, May 12, 1892, H. P. Attwater.
5. Cabot's tern, 25359, Hog Island, Bahamas, May 16, 1892, D. P. Ingraham.
6. Cabot's tern, 25359, Hog Island, Bahamas, May 16, 1892, D. P. Ingraham.
7. Cabot's tern, 25359, Hog Island, Bahamas, May 16, 1892, D. P. Ingraham.

Plate 90.

1. Gull-billed tern, 21522, Cobb Island, Virginia, May 30, 1871, Rev. C. M. Jones.
2. Gull-billed tern, 21539, Texas, Dr. J. C. Merrill.
3. Forster's tern, 18124, Rapeza Marsh, Virginia, July, 1880, R. Ridgway.
4. Forster's tern, 21548, Minneapolis, Minn., 1876, E. Dickinson.
5. Common tern, A. C. Bent collection, Lake Winnepegosis, Manitoba, June 19, 1913, A. C. Bent.
6. Common tern, A. C. Bent collection, Chatham, Mass., June 29, 1916, A. C. Bent.

7. Common tern, A. C. Bent collection, Jericho Bay, Maine, June 17, 1899, A. C. Bent.
8. Common tern, A. C. Bent collection, Chatham, Mass., May 26, 1916, A. C. Bent.

PLATE 91.

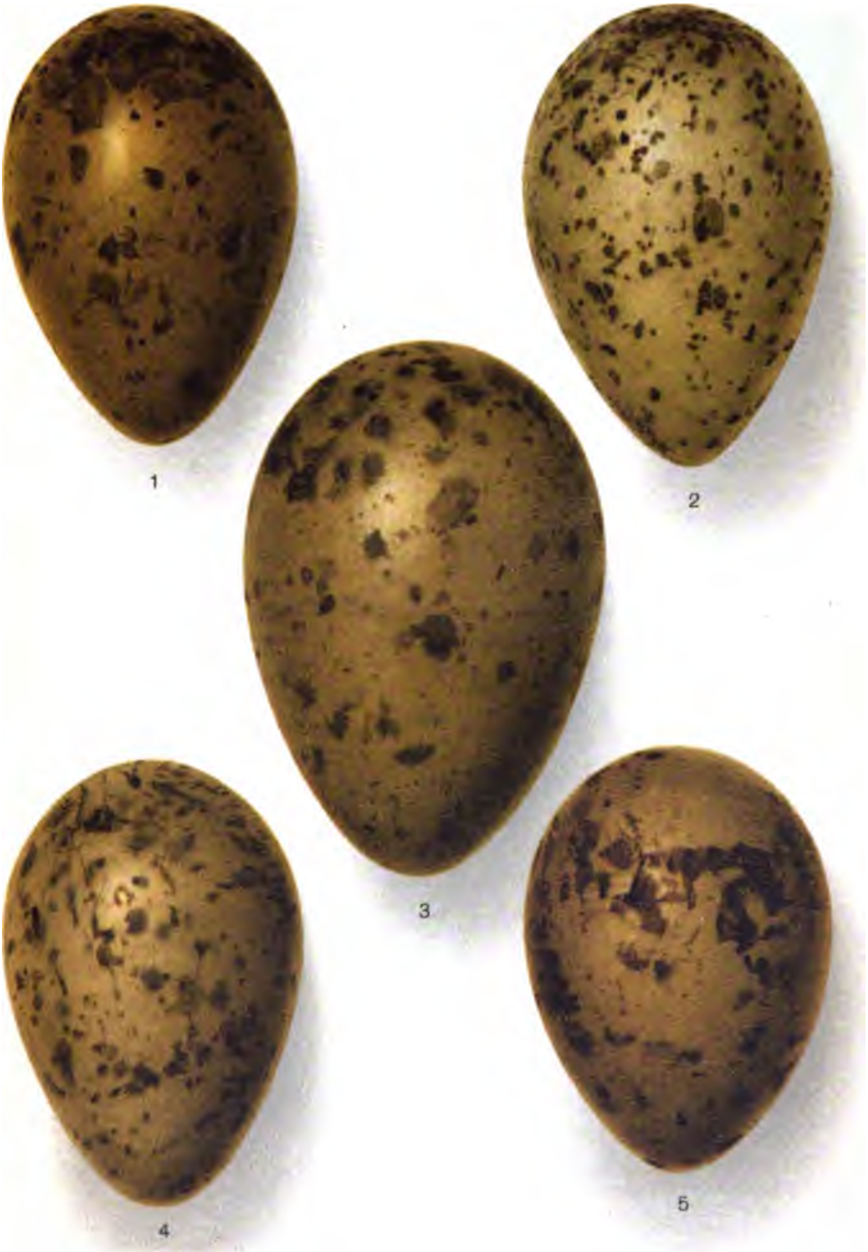
1. Arctic tern, 7831, Anderson River, MacKenzie, June 23, 1865, R. McFarlane.
2. Arctic tern, 23333, Muskeget Island, Massachusetts, June 21, 1884, J. C. Cahoon.
3. Arctic tern, 15183, Sable Island, Nova Scotia, P. S. Dodd.
4. Roseate tern, 12795, East Windsor Hill, Connecticut, Dr. Wood.
5. Roseate tern, 21521, Cobb Island, Virginia, May 31, 1871, C. M. Jones.
6. Roseate tern, 21521, Cobb Island, Virginia, May 31, 1871, C. M. Jones.
7. Aleutian tern, 13471, Kodiak Island, Alaska, 1868, F. Bischoff.
8. Aleutian tern, 17228, Saint Michael, Alaska, July 1, 1875, L. M. Turner.
9. Trudeau's tern, J. E. Thayer collection, Saint Ambrose Island, Saint Felix Group, Chile, December 17, 1907, H. Ozan.

PLATE 92.

1. Sooty tern, 23917, Ship Channel Keys, Bahamas, May 28, 1889, D. P. Ingraham.
2. Sooty tern, 9751, Jamaica, 1864, W. T. March.
3. Sooty tern, 9790, Dry Tortugas, Florida, L. Greenwood.
4. Sooty tern, 1751, Dry Tortugas, Florida, L. Greenwood.
5. Bridled tern, 24823, Atwoods Island, Bahamas, May 14, 1891.
6. Bridled tern, 24362, Samona Keys, Bahamas, June 14, 1891, D. P. Ingraham.
7. Bridled tern, 24839, Atwoods Island, Bahamas, June 10, 1891.
8. Bridled tern, 33060, Desecheo Island, Porto Rico, June 15, 1912, A. Wetmore.

PLATE 93.

1. Noddy, 4989, Dry Tortugas, Florida, T. J. Greenwood.
2. Least tern, 2948, Saint Georges Island, Florida, G. W. Maslin.
3. Noddy, 4989, Dry Tortugas, Florida, T. J. Greenwood.
4. Black tern, 21527, Camp Harney, Oregon, June 1, 1876, C. Bendire.
5. Black tern, 21523, Pewaukee, Wisconsin, May 27, 1872, B. F. Goss.
6. Black tern, 15177, Pewaukee, Wisconsin, 1869, B. F. Goss.
7. White-winged black tern, A. C. Bent collection, Ungane, Hungary, May 28, 1906. Kudeldorff collection.
8. Black skimmer, 23318, Galveston, Texas, July 1, 1878, N. S. Goss.
9. Least tern, 24349, Chincoteague, Virginia, June 5, 1888, M. H. Bickley.
10. Black skimmer, 18147, Bone Island, Virginia, R. Ridgway.



A. Hoen & Co. Baltimore

1 AND 2. POMARINE JAEGER
3. SKUA
4 AND 5. PARASITIC JAEGER

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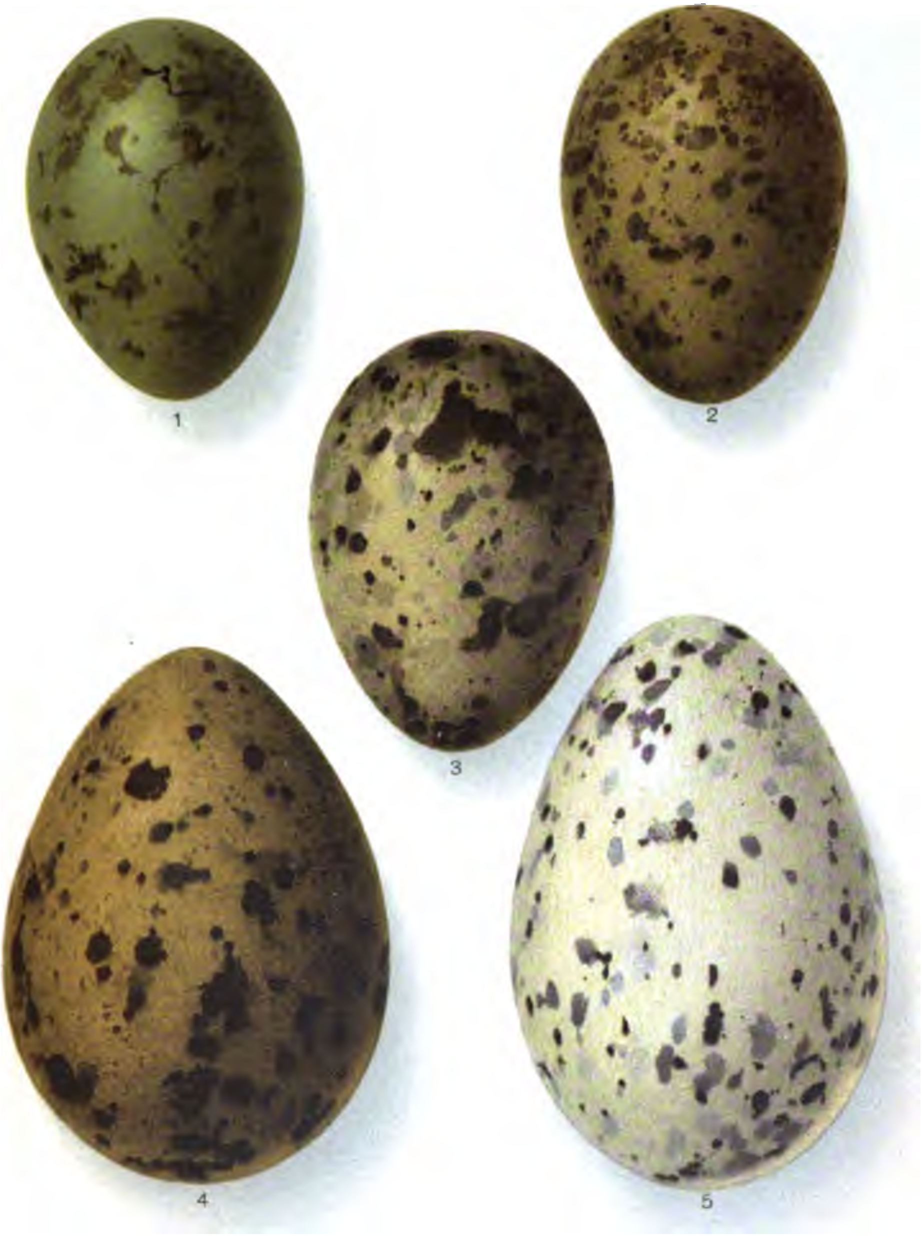

A. Hoen & Co. Baltimore

1 and 2. Long-tailed Jaeger
3. Ivory Gull
4 and 5. Glaucous-winged Gull

FOR DESCRIPTION SEE PAGE 338

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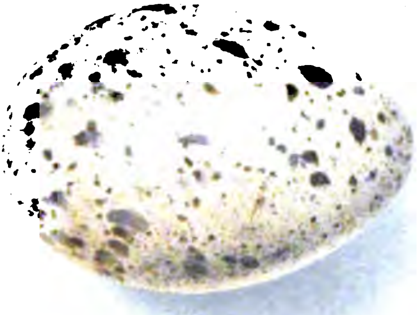

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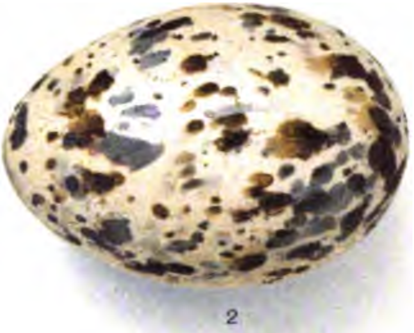

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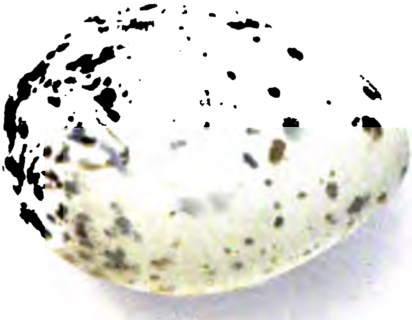

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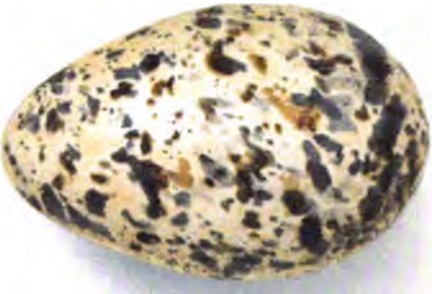

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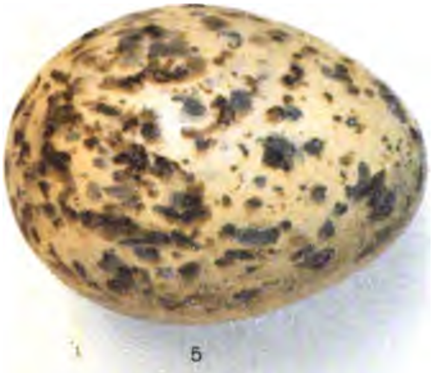

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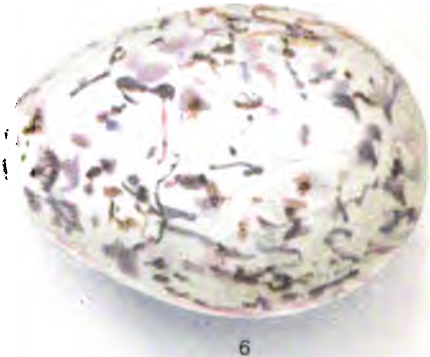

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1 AND 2. KITTIWAKE
3 AND 4. PACIFIC KITTIWAKE
5 AND 6. RED-LEGGED KITTIWAKE

FOR DESCRIPTION SEE PAGE 338

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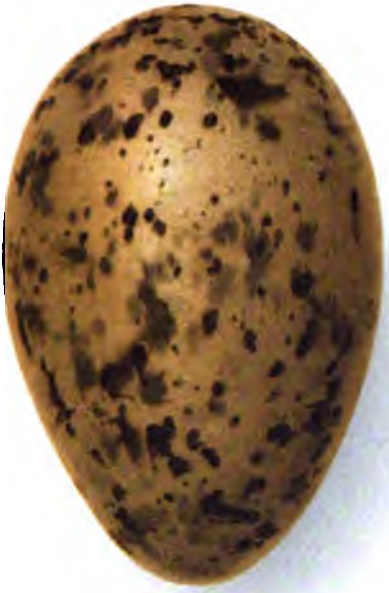

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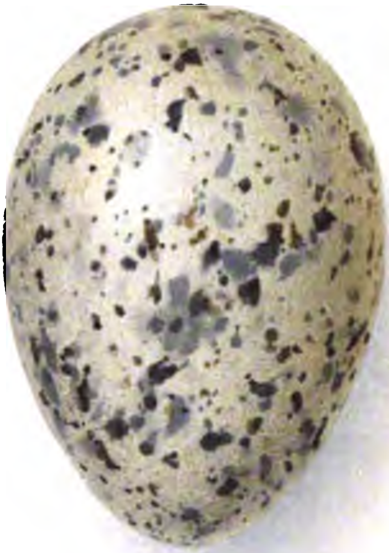

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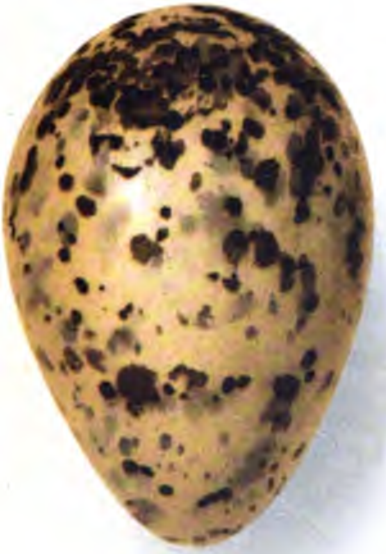

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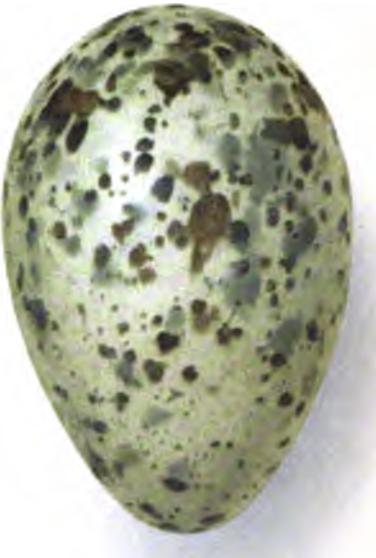

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1 AND 2. GLAUCOUS GULL
3 AND 4. ICELAND GULL

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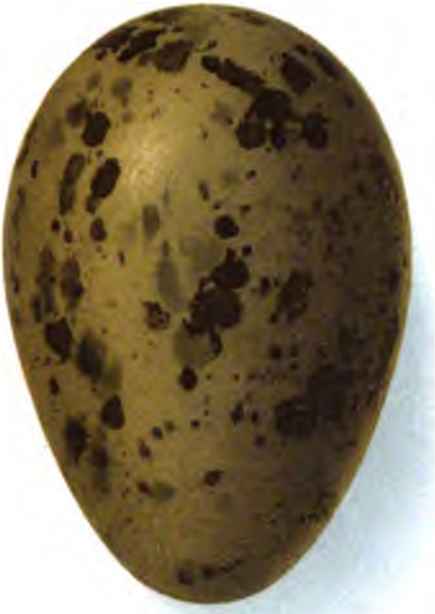

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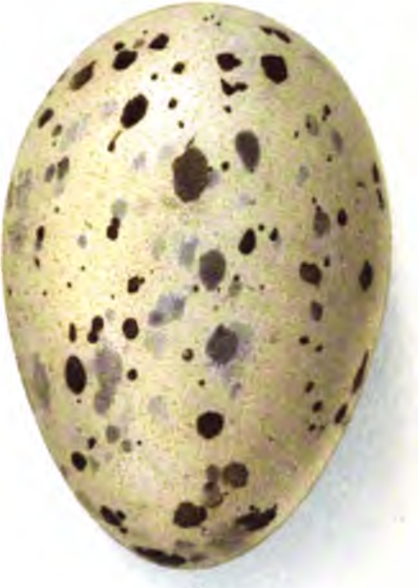

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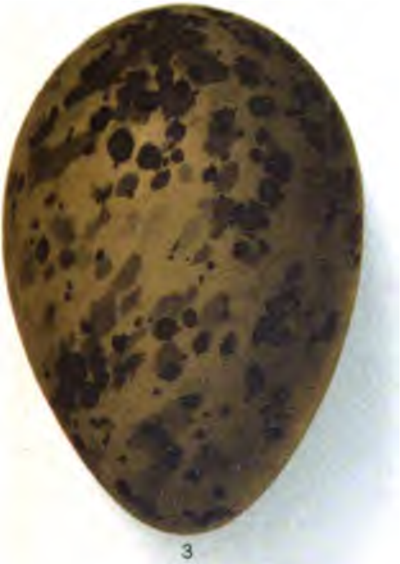

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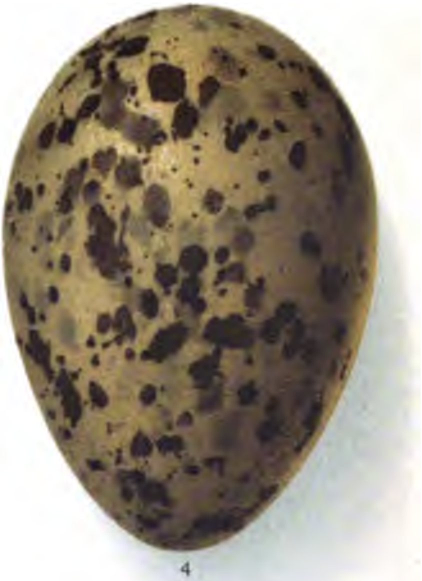

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A Hoen & Co Baltimore

1 and 2. Great Black-backed Gull
3 and 4. Western Gull

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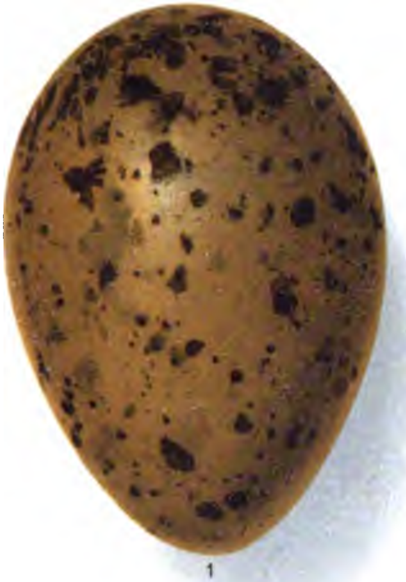

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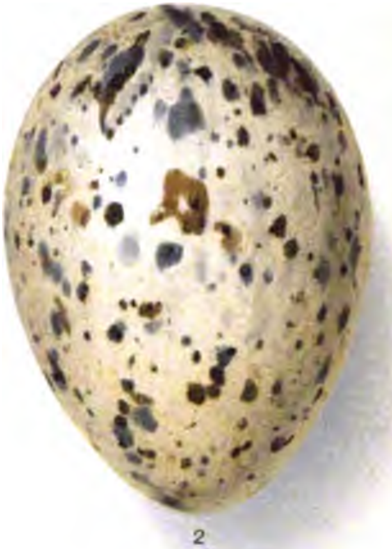

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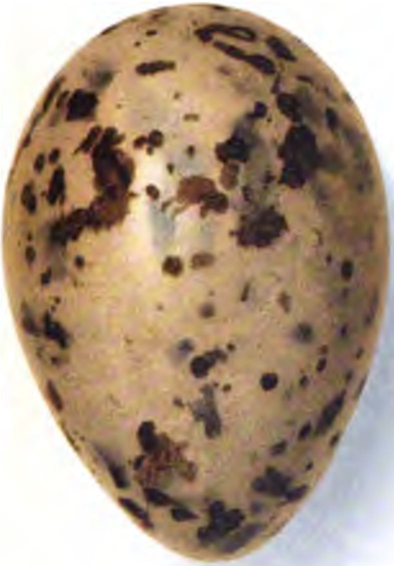

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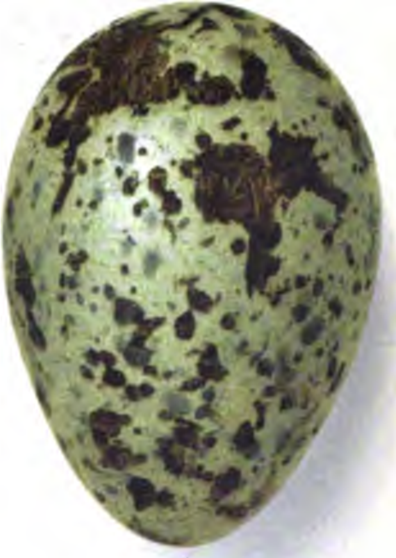

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A Hoen & Co. Baltimore

1 AND 2. HERRING GULL
3 AND 4. VEGA GULL

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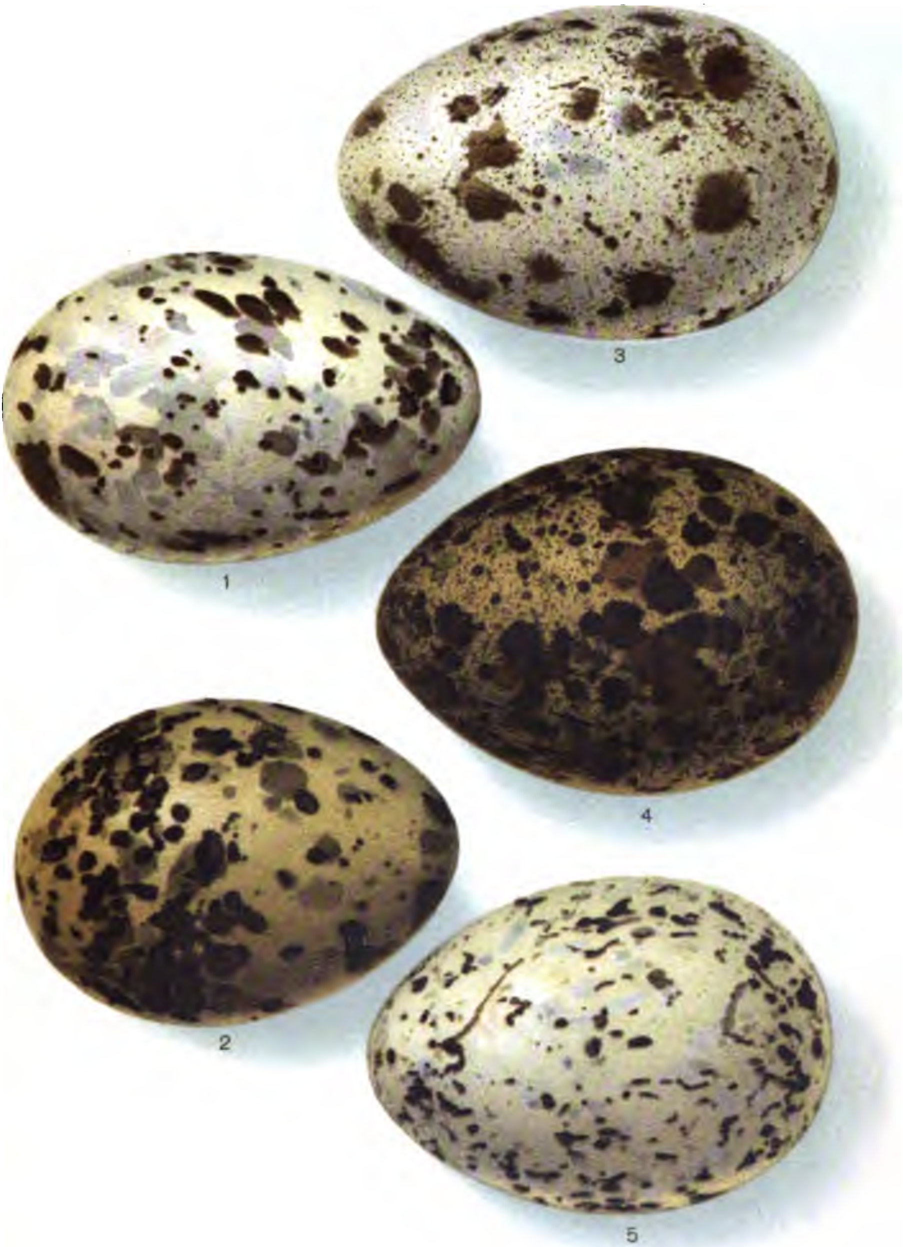

A.Hoen & Co Baltimore

1 AND 2. RING-BILLED GULL
3, 4 AND 5. CALIFORNIA GULL

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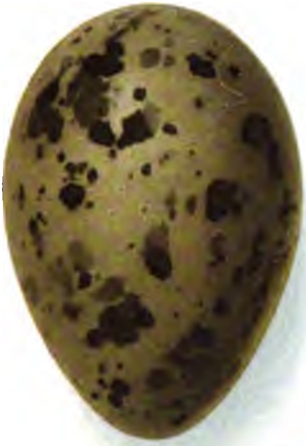

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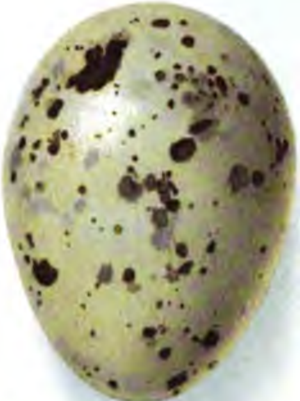

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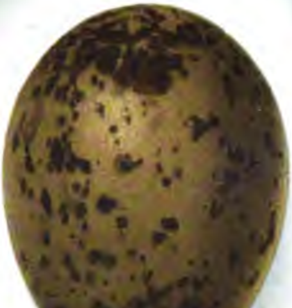

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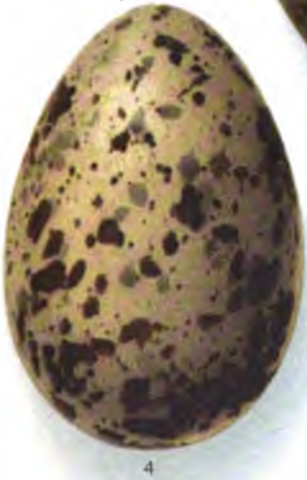

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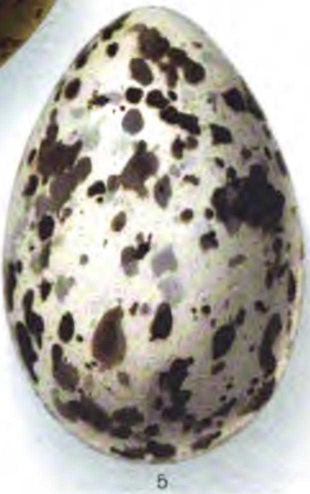

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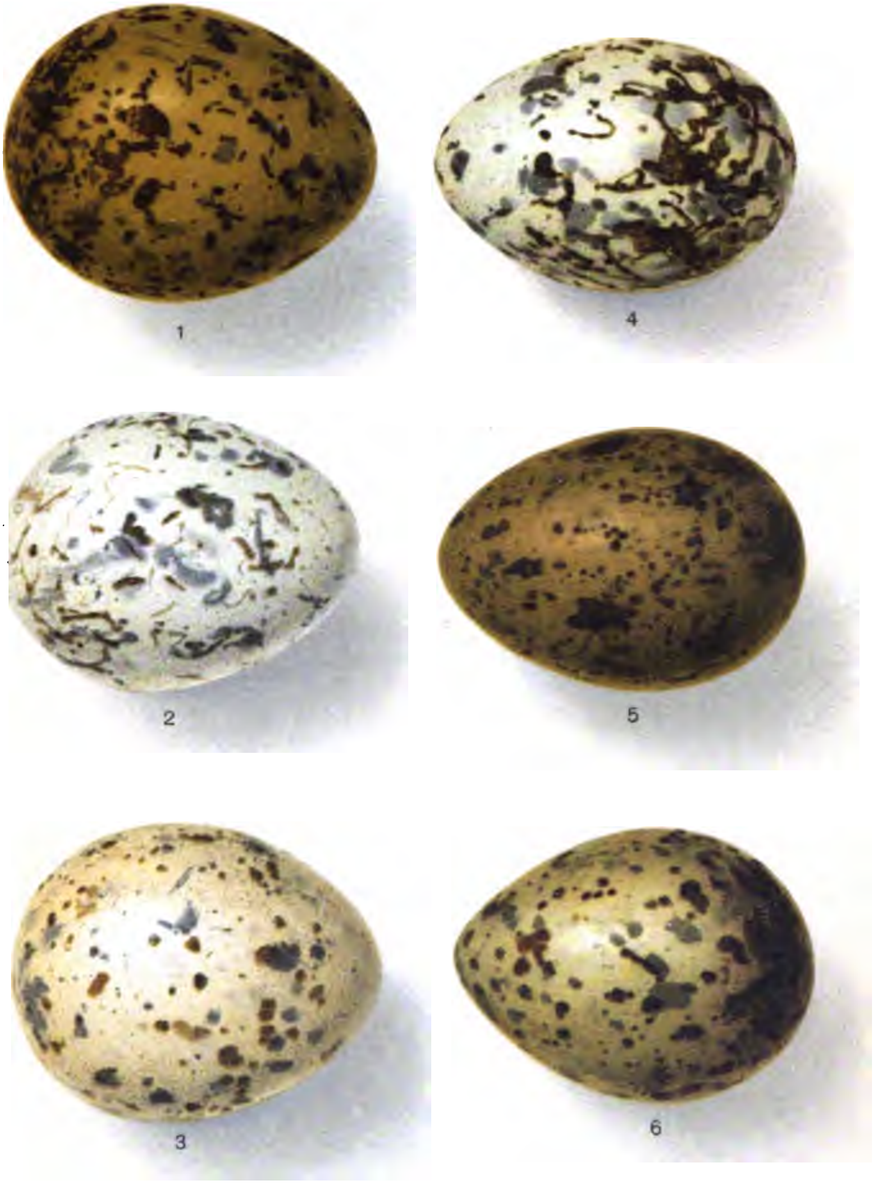
A Hoen & Co. Baltimore

1 AND 2. SHORT-BILLED GULL
3. MEW GULL
4 AND 5. HEERMANN'S GULL

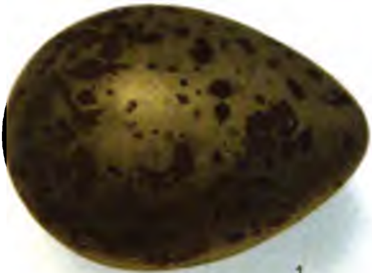
FOR DESCRIPTION SEE PAGES 338 AND 339



A.Hoen & Co.Baltimore

1, 2 AND 3. LAUGHING GULL
4, 5 AND 6. FRANKLIN'S GULL

FOR DESCRIPTION SEE PAGE 339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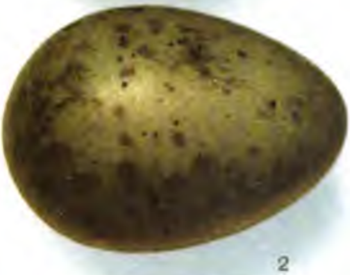
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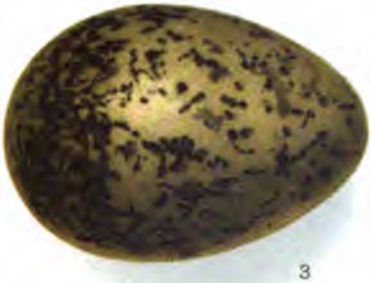
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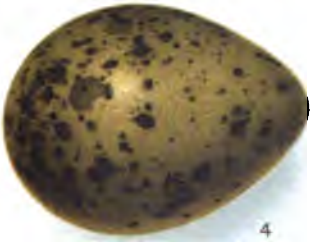
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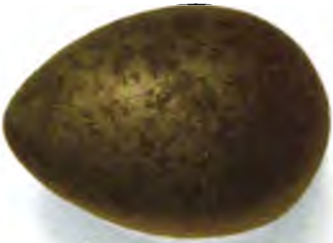
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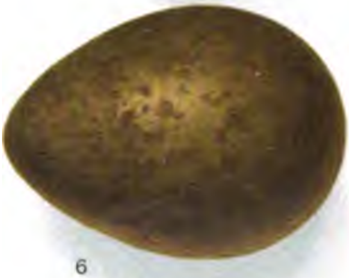
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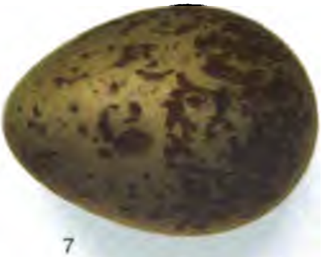
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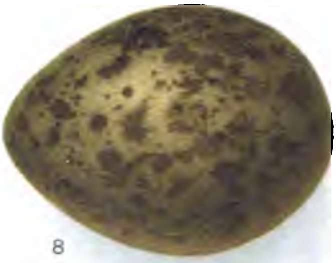
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A.Hoen & Co. Baltimore

1, 2 and 3. Bonaparte's Gull
4. Little Gull

5. Ross's Gull
6, 7 and 8. Sabine's Gull

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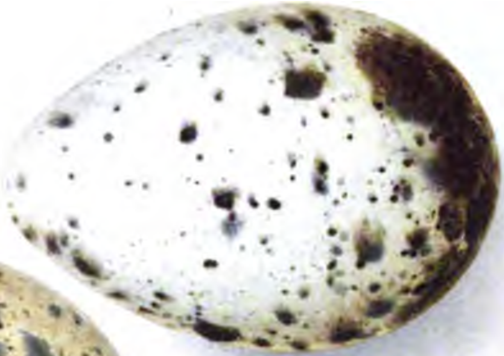

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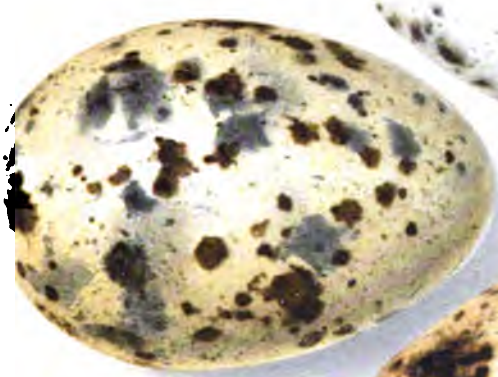

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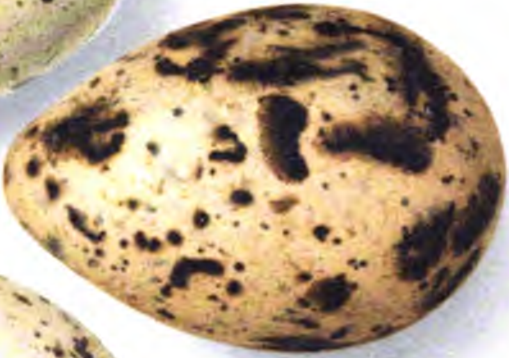

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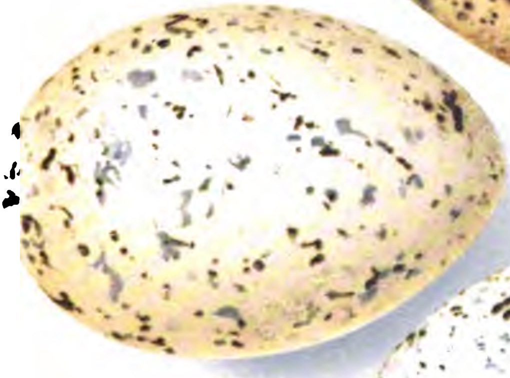

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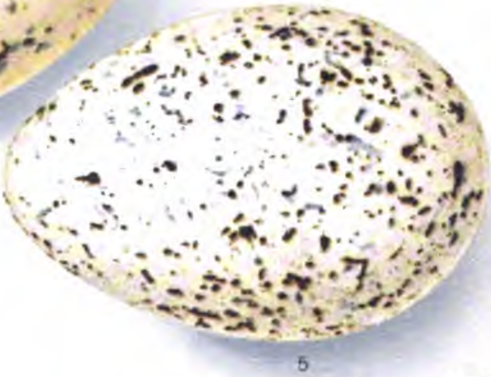

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A. Hoen & Co. Baltimore

1 AND 2. CASPIAN TERN
3, 4 AND 5. ROYAL TERN

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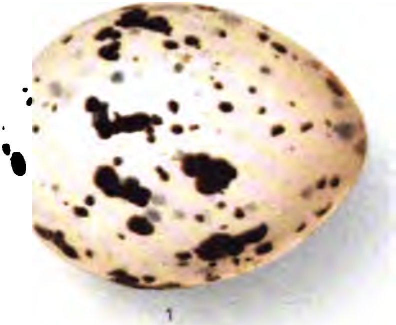

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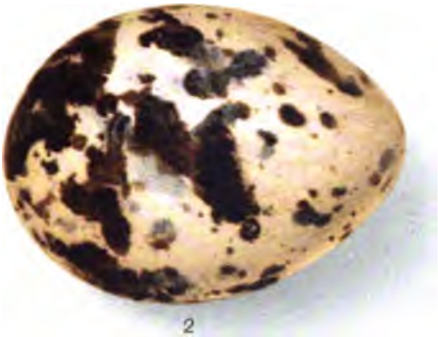

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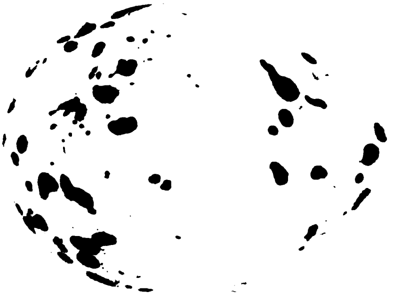

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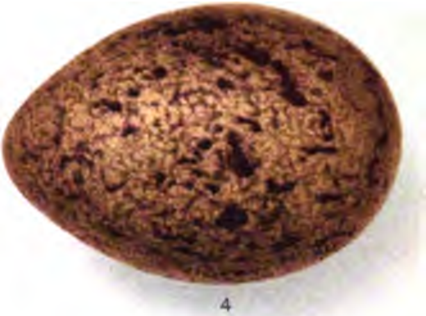

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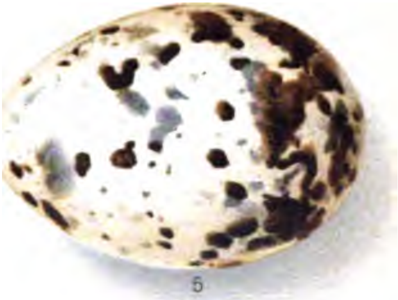

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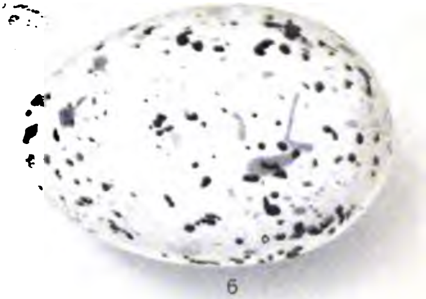

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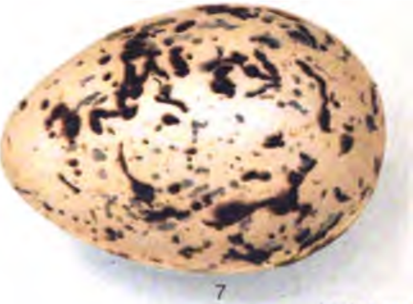

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A.Hoen & Co. Baltimore.

1, 2 AND 3. ELEGANT TERN
4, 5, 6 AND 7. CABOT'S TERN

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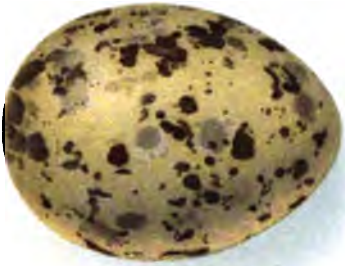
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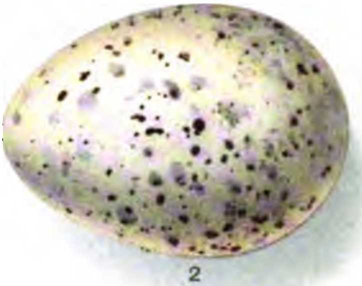
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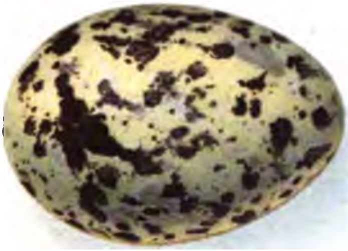
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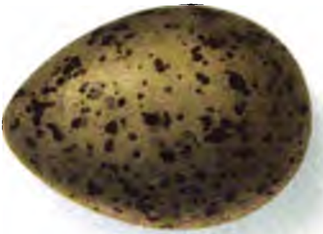
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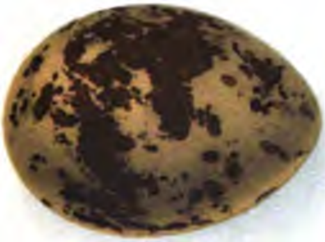
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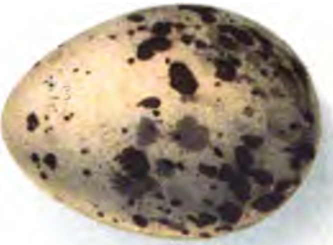
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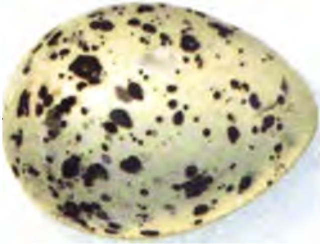
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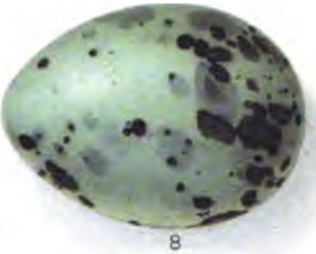
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A. Hoen & Co. Baltimore

1 and 2. Gull-billed Tern
3 and 4. Forster's Tern
5, 6, 7 and 8. Common Tern

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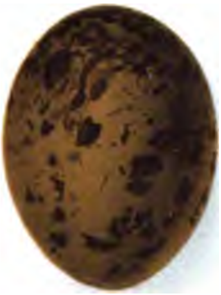

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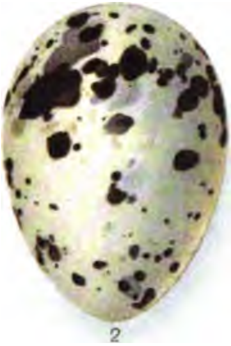

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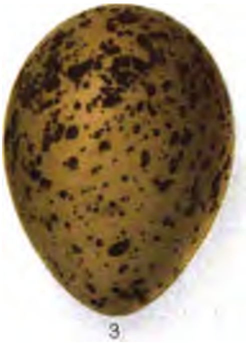

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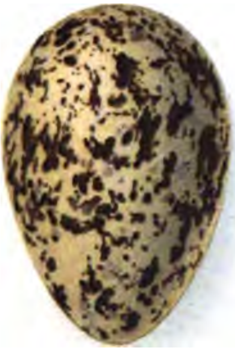

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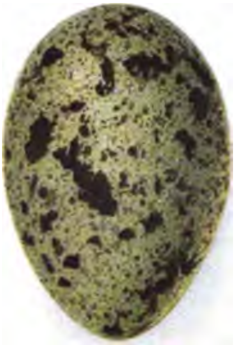

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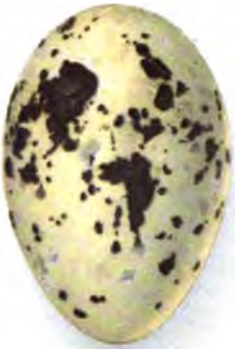

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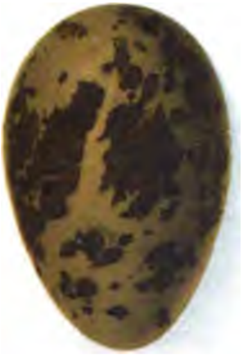

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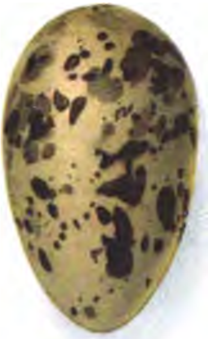

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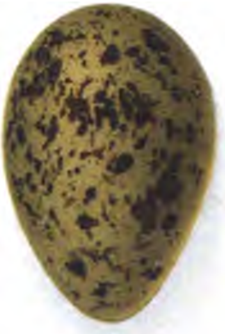

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A.Hoen & Co. Baltimore

1, 2 and 3. Arctic Tern
4, 5 and 6. Roseate tern
7 and 8. Aleutian Tern
9. Trudeau's Tern

FOR DESCRIPTION SEE PAGE 340

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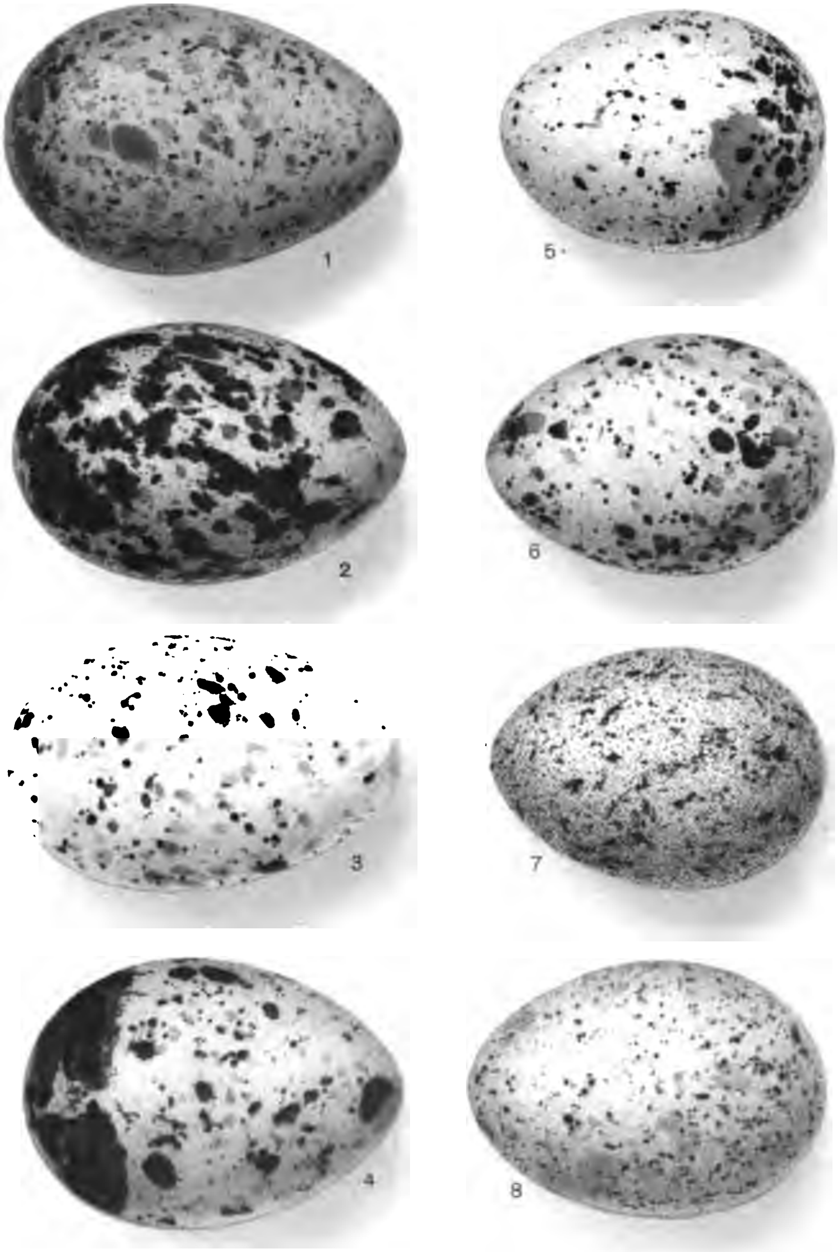

A Hoen & Co. Baltimore

1, 2, 3 AND 4. SOOTY TERN
5, 6, 7 AND 8. BRIDLED TERN

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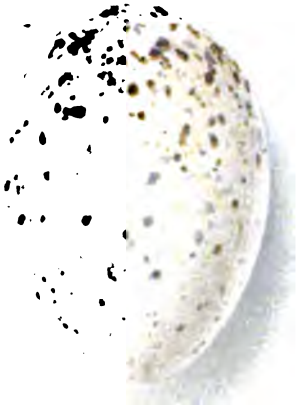

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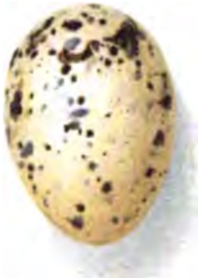

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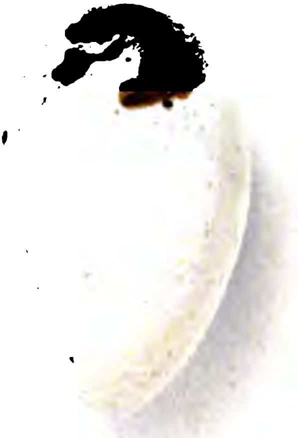

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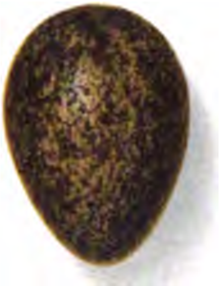

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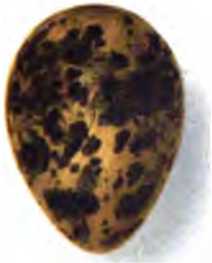

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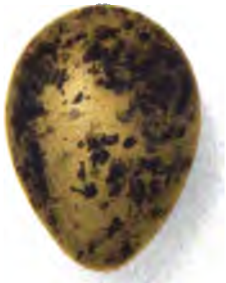

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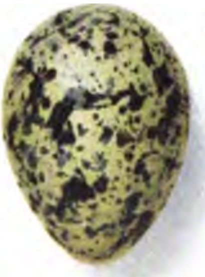

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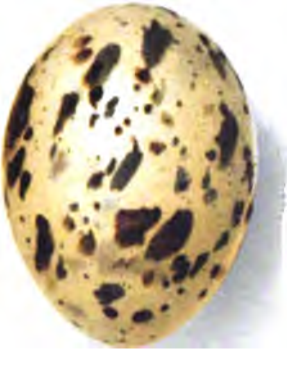

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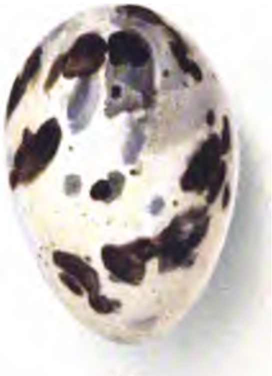

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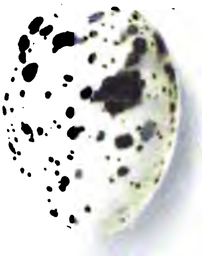

9

A Hoen & Co. Baltimore

1 and 3. Noddy
2 and 9. Least Tern
4. 5 and 6. Black Tern
7. White-winged Black Tern
8 and 10. Black Skimmer

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